FRIDAY, APRIL 6, 1883.

DISTRIBUTION OF PUBLIC DOCUMENTS.

The report regarding the publication and distribution of public documents, prepared by a special committee of experts, Messrs. Ames, Spofford, and Baird, and recently issued from the Government printing-office, is the fruit of one of those spasms of virtue that is apt to overtake spendthrifts, individual or corporate, at the end of a period of peculiarly unreasonable waste and folly. In any well-managed government, the conditions which this report shows to exist would be a matter for chagrin and for immediate remedy; but, as the remediable waste probably does not exceed a million of dollars at the most, it will be perhaps too trifling an evil for attention.

The committee report that they "are very deeply impressed with the number of documents printed by authority of Congress, aggregating, for the forty-sixth Congress, 2,324,254, and, for the first session of the forty-seventh Congress, 1,354,947. . . . They are no less deeply impressed with the lack of system and economy in the distribution of these documents. . . . Under the practice now prevailing, nearly all documents, whatever may be their cost and value, are distributed by from two to four agencies, each in ignorance of what the others are doing."

They recommend a single agency for all the distribution, that the public libraries have the first care, and that discretion be shown in the choice of libraries which are to receive the full sets of congressional documents. They print twenty-four pages of tables, giving, in fine type, a list of the 'documents' printed by the forty-sixth Congress, — a wonderful list, in which the transit of Venus comes against the Fitz John Porter case, and the eulogies on Z. Chandler succeed the nautical almanac. Congress assumed that twelve thousand persons needed to hear what Congress said on the death of the above-named statesman, while only half that number needed information on the chinch-bug; three thousand required information on the flags of maritime nations, while only twelve hundred wanted the third volume of the geological survey.

The number of scientific books is surprising. There are about fifty volumes upon such topics, not including reports that are partly scientific, nor the census publications, many of which should be placed in this category.

One of the results of this deluge of free scientific books is, that any private publication of works of this nature is well nigh impossible in this country. Our people have been brought to the state of mind where they assume that any large, well-printed, elaborately illustrated work was, of course, made to be given away.

There are good reasons for the publication of most of the public scientific works. Many of them are an honor to the government, and of great value to science; but the system of distribution has been to the last degree absurd, and not a little damaging to the best interests of scientific men. The publication of this document, and the recent action of Congress, are steps towards the reform of the evil. If the government will heed the sagacious recommendations of their committee, the worst of these evils will be cured.

THE VARIATION OF TEMPERATURE UNDER CONDITIONS PRESUMABLY THE SAME.

In all comparisons of standards of length, the accurate ascertainment of the temperature is a matter of the utmost importance. A neglect of proper precautions in regard to this point will frequently, if not generally, introduce greater uncertainty into the results than all other sources of error combined. The importance of knowing the temperature will be readily admitted by all, but the difficulty of ascertaining it is by no means fully appreciated. The writer has himself seen costly and elaborate comparators which were used in the open air of a room without any provision for protecting the bars under comparison from the influence of heat radiated from the observer's body. He has also read letters of persons whose ideas of accuracy were far beyond their ability to achieve, and who wished for the standards they would send for comparison a refinement of determination that would be instantly lost in the uncertainty of the temperature under the conditions to which they

would be subjected in use. It is this difficulty of accurately knowing the temperature, that has demanded the expenditure of so much time, talent, and money, in the construction of compensating bars for base measurement. Were it possible for a thermometer to accurately

Fig. 1.

register the temperature of a metallic bar beside which it was laid, a simple rod or bar would form the most accurate base-measuring apparatus, as there would be no risk of any parts getting out of order.

In the comparisons upon which he has been engaged in the Bureau of U. S. standard weights and measures, the writer has had frequent occasion to notice the variations of temperature under conditions which would ordinarily be presumed to be the same; and he has had forcible evidence of the fact, that no matter how well the conditions are controlled, or how carefully the bars may be protected, we can never rely upon two bars having the same temperature. No doubt they often have the same temperature; or, when a difference exists, its effect is inappreciable. Still, there is an uncertainty in the matter which can be eliminated only by a careful interchange of relative positions.

A marked illustration of what is said above is given in the following case. The comparisons were made by the writer. The circumstances of comparison were as follows: seven steel end-metres were to be compared with a standard metre. The comparisons were made in a room about 20×16 feet in size. This room was at the north-east corner of the building, so that two of its sides were outer walls. They were about two feet thick. The room was below the level of the street in front, but had free circulation of air around the outer sides, the building being separated from the coal-vaults in front by an area five or six feet wide. The comparator was parallel to the eastern (longer) side of the room, and about three feet from it. The doors of the room were kept closed, and the daily range of the temperature seldom exceeded three degrees. Two windows in the eastern wall were closed with a double glass sash and a solid wooden frame; and, to more effectually close them against passage of air, heavy manila paper was closely pasted over the entire frames. The eight bars were supported on racks, in two groups of four each, on both sides of the position that a bar would have when lying between the abutting-screw and contact-slide of the comparator. As the bars lay in the rack, they were about three-quarters of an inch apart from centre to centre. The extreme bars were about seven inches apart. The arrangement is shown in Fig. 1.

The bed-plate of the comparator was a framework of solid wood several inches thick. The bars and comparator were covered by a framework of wood and heavy plate-glass. The manipulation of the bars was effected by long pliers working through two narrow slits in the top of the case. As an extra precaution, a covering of heavy paper was placed over the whole. In manipulating the bars, the observer stood between them and the wall; so that, if the heat from his body succeeded in penetrating the casing, the effect would be to *diminish* the variations observed, and not to increase or to produce them. Numbering the notches in the rack from 1 to 8, the former being the nearest to the wall, the order of arrangement and change was as follows: the

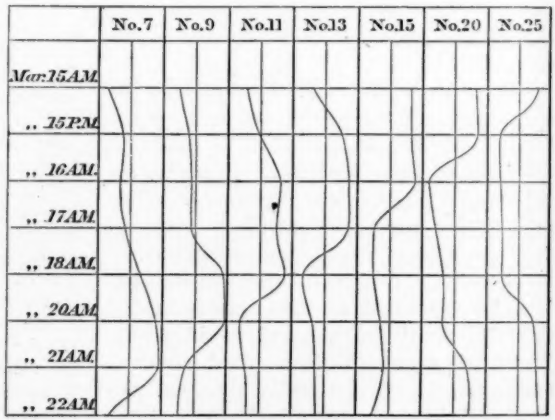

Fig. 2.

standard remained constantly in No. 5; after each set of comparisons, the bar in No. 8 was put in No. 1; each other bar being moved forward one space, except that in No. 4, which

was moved to No. 6. Now, it will be seen from the comparisons, that the influence of the cold wall was such, that despite the care with which the bars were protected, and their nearness together, each one had a different length for each position that it occupied.

When the comparisons had continued for two or three days, it was seen that the range of individual results was greater than should be from mere errors of comparison. The true cause was not, however, suspected until the set had been completed by running the bars through each position of the rack, returning to the arrangement with which the set started. The following table gives the relation of the standard to the steel metres, the differences being expressed in microns (one micron equals one-thousandth of a millimetre).

	No. 7.	No. 9.	No. 11.	No. 13.	No. 15.	No. 20.	No. 25.
March 15, A.M. .	−8.9	−4.0	−9.4	+2.1	+0.1	−5.3	−10.9
" 15, P.M. .	7.4	3.2	8.2	4.7	0.1	5.1	14.6
" 16, A.M. .	7.7	2.9	6.3	5.4	+0.5	9.7	14.6
" 17, A.M. .	7.2	−2.9	6.6	5.4	−3.3	8.9	14.4
" 18, A.M. .	5.8	+0.1	5.8	1.2	3.4	8.3	14.4
" 20, A.M. .	4.3	+0.4	10.0	2.0	2.7	8.3	11.4
" 21, A.M. .	4.0	−3.4	9.4	2.3	2.3	6.0	11.1
" 22, A.M. .	−8.6	−3.9	−9.5	+2.4	−3.4	−5.8	−10.8
	−6.74	−2.48	−8.13	+3.19	−1.80	−7.18	−12.77

While the regularity of the change is apparent in this table, it is much more readily seen in a graphic projection. This is shown in Fig. 2.

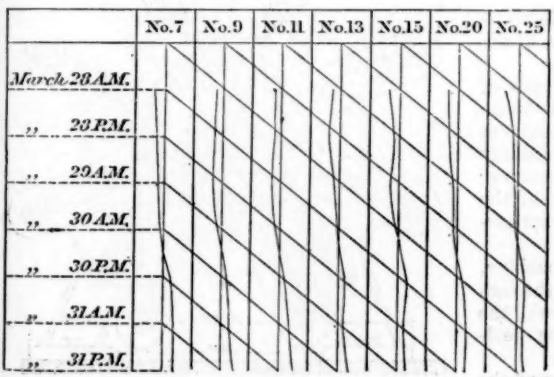

FIG. 4.

The variations from the mean are magnified sixteen hundred times.

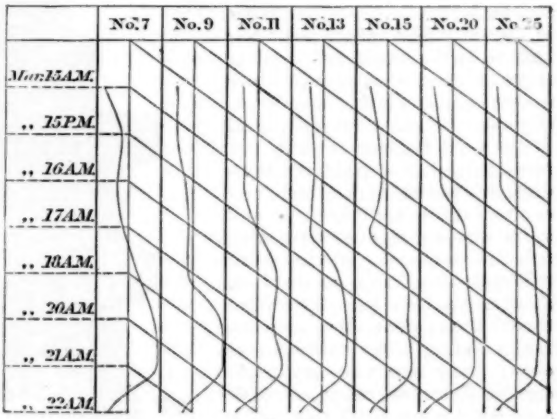

FIG. 3.

In this diagram the vertical lines represent the mean values; and the points in the curves are obtained by using the *differences* from the means as offsets to the right or left, for positive and negative differences. The greatest length of each bar is found when the bar is farthest from the outer wall, and the least length when nearest it. If the differences be shown graphically in parallel projection, the similarity of the curves is still more forcibly shown. This form is given in Fig. 3.

That the variation of temperature within so small a space so carefully protected should have shown so marked an effect, was entirely unexpected. It is susceptible of much more accurate determination through the bars themselves than by the use of thermometers. In the case under consideration, the difference between the extreme positions corresponds to a difference of temperature of about 0.7° F.

To lessen the effect of the influence of the outer wall, other piers were built at double the distance from the wall, and a large screen was placed between the comparator and the wall. The screen was made of a framework of wood, covered on each side with heavy paper. Another series of observations upon the same bars was then begun. The results show the same influence to have been at work; but the effect is very much reduced. A graphic representation is given in Fig. 4.

This illustration presents in a forcible manner the importance of giving the closest attention to the protection of the standards, where refined accuracy is sought. The influence of the heat from the observer's body is frequently less than that of other causes against which protection is supposed to have been made. With a micrometer capable of measuring with certainty a hundred-thousandth of an inch, we can repeat observations again and again with a range not exceeding this amount, and yet the result will differ from that obtained on another day by a quantity several times larger than the extreme range during a set taken all at once. Any one who has made careful linear or other comparisons will have noticed this. The fact that the bars, while subjected to apparently the same influences, are yet differently affected, is the principal cause of this trouble; and the only way of eliminating the effects from the final result is to so change and alternate the bars in position as that the disturbing influences may operate in turn on the one or the other of the standards under consideration. H. W. Blair.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.[1]

V.

It only remains now to describe the de Meritens machine to complete the description of the electric appliances for light-houses.

M. de Meritens has devised several types of machines. The one adapted for light-house purposes, shown in Fig. 16, has the permanent magnets of horseshoe form arranged radially around the axis in a precisely similar manner to the disposition of the field-magnets of the old Alliance machine, which in general appearance it at first sight much resembles.

Fig. 17 is a transverse section of the machine, and Fig. 18 a longitudinal section taken through the axis, so as to show, in both views, the armature ring, and the position of the field-magnets with respect to it.

Figs. 19, 20, and 21 show the details of the armature bobbins marked H, the iron core-pieces, *h h*, and the projecting pole-pieces, which form enlarged ends to the latter, and are marked *g*. In Fig. 19, which represents a

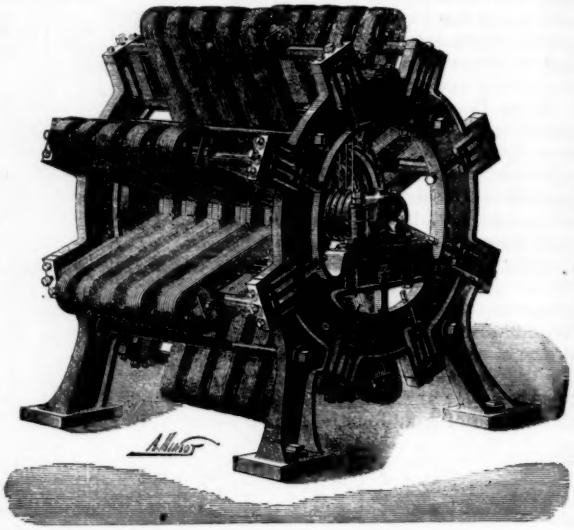

Fig. 16.

section through half the ring, the method of attachment and of coupling up is clearly shown. On reference to Fig. 17, it will be seen that each armature ring, G, is built up of sixteen flattened oval bobbins, H, separated from one

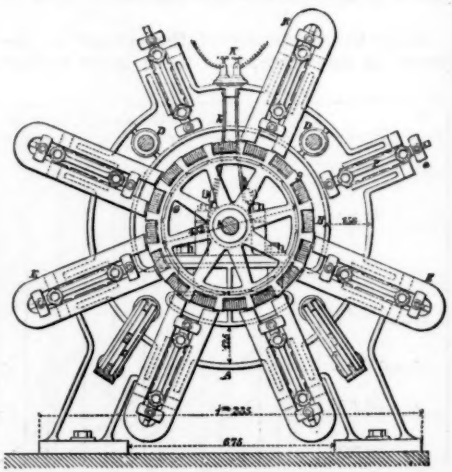

Fig. 17.

another by the projecting pole-pieces, *g*; and around each ring are fixed, radially to the

[1] Concluded from No. 8.

frame of the machine, eight very powerful compound permanent magnets, each composed

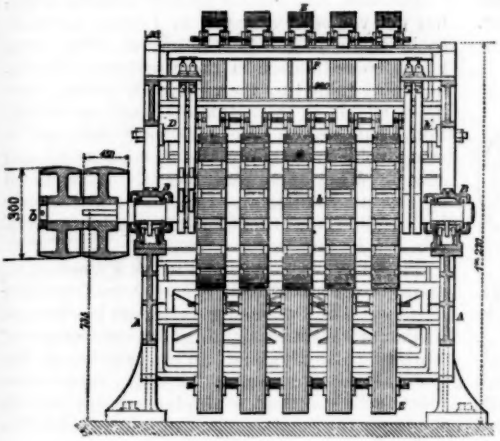

FIG. 18.

of eight laminae of steel. The distance apart of the two limbs of each magnet, as well as the distance between the north pole of one magnet and the south pole of the next, is precisely equal to the distance apart, or pitch around the armature, of the pole-pieces and the coils. The details of the magnets, and their method of adjustment and attachment, are shown in Figs. 22 and 23. Each magnet is built up of eight laminae of steel, each ten mm. in thickness, and are held together tightly by the bolts and nuts, *c d*, the whole being attached to the brass frames, F, which are fixed to the framing of the machine in radial slides, by which the distance from the armature ring can be adjusted with

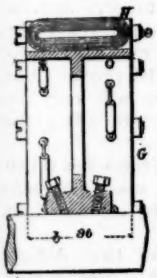

FIG. 19.

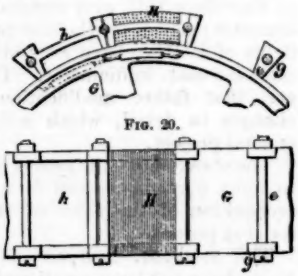

FIG. 21.

great accuracy. The total weight of the forty magnets (see Fig. 16) is about one ton.

The currents from the five armatures are brought together, in two groups, to the four brass collecting-disks, *i*, which are mounted in pairs on an insulated bush, *j*, fixed to the principal shaft of the machine. The details of the collecting-apparatus are shown in Figs. 24, 25, and 26. Against the disks, *i*, are pressed, by means of springs, the four collecting plates or brushes, K′ K′, which are in metallic connection with the attachment screws, K K, of which there are two pairs,—one at each end of the machine (as shown in Fig. 18).

The construction of the armature is very interesting and ingenious. Each of the induction coils shown at H (Figs. 19, 20, and 21) is composed, first, of a flat spool or bobbin of the form marked *h*, and then is wound in a lathe with insulated copper wire 1.9 mm. in diameter, and of which the total weight in the whole machine is from 120 to 130 pounds. The iron cores of these coils are built up of eighty thicknesses of soft sheet-iron one milli-

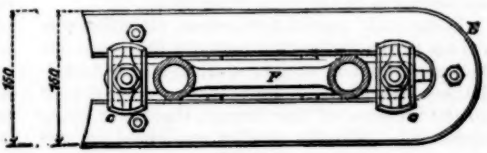

FIG. 22.

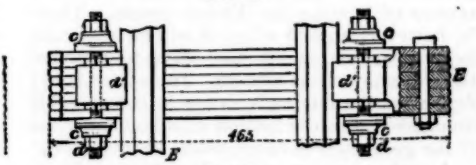

FIG. 23.

metre in thickness, and stamped out by a machine. The coils are wound, and attached to the armature wheel by a set of bolts marked *e*, which pass through the projecting lugs, *g*, of the wheel, and through the cylindrical hole formed by the semi-cylindrical grooves in the ends of the iron core-pieces when abutting the one against the other.

The coupling-up of the armature coils is one of the most ingenious features of the machine; for, as the magnets are arranged around the armature in such a way that, in the rotation of the coils, alternate poles are presented to any one bobbin, it follows, that if the bobbins were numbered 1, 2, 3, 4, etc., up to 16, the currents induced in all the even-numbered bobbins would be in one direction, and in all the

odd numbers in the opposite; and it would appear at first sight that these coils could not be connected together in series without the one set of currents neutralizing the other.

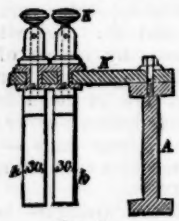

Fig. 24.

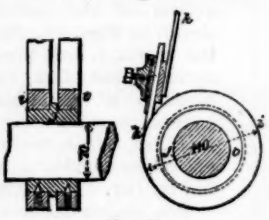

Fig. 25.

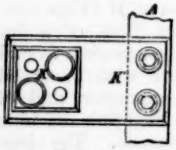

Fig. 26.

But, by connecting the armature coils together in the manner shown in Fig. 27 it will be seen, that although the currents generated in consecutive coils are opposite in direction to one another, yet their combined current transmitted to the collecting-apparatus is in the same direction.

In the early part of this article, attention was drawn to the distinction between the luminous and geographical range; and, in all the installations described, regard has only been paid to the increase of the former, the latter being neglected. This is readily explained by the necessity there was of giving a unit to the new system of lighting the French coasts. There is, however, a point which it will be important to consider, and which may serve to augment the efficiency of the system. In days of heavy fog, when the luminous range is considerably diminished, this diminution would be much less if the geographical range could be increased.

A rather important step has been made in this direction by the use of specially constructed optical apparatus. This apparatus is furnished on the upper part with a series of annular lenses, whose effect is to project above the light a beam of vertical rays extending to a great height. This beam illumines either the clouds, or the vapor which fills the atmosphere, and is even visible in clear weather, because the air contains enough particles, both solid and vaporous, to allow the phenomenon of diffusion to be produced. These luminous rays thus projected are visible to quite a distance even in foggy nights, and the geographical range is notably increased.

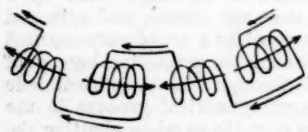

Fig. 27.

The first application of this system, which has not yet been adopted in France, is about to be made in the Sea of Azof. The ships which cross this sea in the direction of Berdiansk are guided to their point of arrival by a light, which, in the actual state of its installation, could not be seen sufficiently far; and it was decided to apply the system mentioned above. The apparatus recently constructed by Messrs. Sautter and Lemonnier will shortly be installed, and then the efficacy of the system can be judged.

The example thus given by the French light-house board has already been followed by other nations. The Ottoman government has studied a plan of electric lighting for the coasts of Turkey. In England an appropriation has been asked to establish, in 1881, about sixty electric lights; and a similar request will be made for the establishment of a hundred lights in 1882.

On account of the time which the complete execution of the project for lighting the French coasts will take, it may be that the experience obtained with the first lights will show some modifications to be made to the adopted plan, and that the lights last made may not have entirely the same dimensions and characteristics as those first built.

In fact, some criticisms have been made by foreign engineers, especially on the diameter of 0.6 met. of the optical apparatus, — a diameter which these engineers consider relatively too small. The faults ascribed to optical apparatus of small diameter are those of heating too readily on account of the proximity of the luminous *foyer*, and also that of being more quickly covered with carbon-dust. We do not, however, believe that there is much to fear from this with apparatus 0.6 met. in diameter; since, for the last twenty years, the lights of la Hève have worked well with apparatus 0.3 met. in diameter. The probabilities are, that future modifications will only be changes in detail, which will not affect the general project.

The above shows the means France has taken to light her coasts, and is a most emphatic recognition of the value of the electric light for that purpose.

The arc-light, however, has two defects which have not been mentioned, — one, a lack of fixity; the other, a deficiency in the red and yellow rays of the spectrum. This lack of fixity is partly due to the carbons not being homogeneous, and partly to faults in the regu-

lators. Improved processes of manufacture have in a great measure removed these defects, but even the best lights will still occasionally flicker.

The red and yellow rays have the greatest penetrating power; and for this reason an oil-light, which is rich in these rays, can be seen farther in foggy weather than an electric light of *equal candle-power*. But the electric light can be made so much more powerful than the best oil-light, that this deficiency can be more than made up; still, it must be borne in mind when the candle-powers of the two lights are compared.

When the French system was adopted, the incandescent electric light had not left the domain of experiment; and even now its luminous intensity is very much less than that which can readily be obtained from an arc-light of moderate dimensions. It possesses, however, the element of remarkable fixity, and is rich in red and yellow rays. No light could be better for a light-house, if it can be produced cheaply, have sufficient luminous intensity, and be made reliable. It will, moreover, dispense with the somewhat complicated and expensive regulators.

It is in this line that the Light-house board of the United States is about to make experiments, and the results obtained will have great interest for the whole world.

DAVID PORTER HEAP.

GEOLOGICAL NOMENCLATURE AND COLORING.

THE following stratigraphical divisions have been provisionally adopted by the international commission of the geological map of Europe. The colors placed against them are those proposed by the directors.

1. Gneiss and protogine. Bright rose-red.
2. Crystalline schists (mica schists, talc and chlorite schists, amphibole schists, and foliated gneiss). Medium rose-red.
3. Phyllites (argillaceous schists, urthonschiefer). Pale rose-red.
4. Cambrian (all fossiliferous beds below the Llandeilo flags; primordial fauna, Taconic). Reddish gray.
5. Silurian, lower fauna (second of Barrande). Dark silk-green.
6. Silurian, upper fauna (third of Barrande). Light silk-green.
7. Devonian, lower. Dark green-brown.
8. Devonian, middle (limestone of the Eifel). Medium green-brown.
9. Devonian, upper. Light green-brown.
10. Carboniferous, lower (culm, mountain limestone, etc.). Blue-gray.
11. Carboniferous, upper (houillier, millstone-grit, etc.). Gray.
12. Permian (dyas), lower (rothliegendes, etc.). Burnt sienna.
13. Permian (dyas), upper (zechstein and equivalents). Sepia.
14. Trias, lower (grès bigarré). Dark violet.
15. Trias, middle (muschelkalk). Medium violet.
16. Trias, upper (keuper and equivalents). Light violet.

16′. *Rhetic*, provisionally (haupdolomit excluded).

17. Jurassic, lower (lias). Dark blue.
18. Jurassic, middle (dogger, kellovien included). Medium blue.
19. Jurassic, upper (malm with tithonic and Purbeck). Light blue.
20. Cretaceous, lower (Neocomien and Wealdian). Dark green.

20′. *Gault*, provisionally.

21. Cretaceous, upper (from the cenomanien). Light green.
22. Eocene (nummulitic, etc.). Orange-yellow.

22′. *Flysch*, provisionally.

23. Oligocene (with the aquitanien). Dark yellow.
24. Miocene (mollasse). Medium yellow.
25. Pliocene. Light yellow.
26. Diluvium. Naples yellow.
27. Alluvium. White.

The subdivisions, 'Rhetic,' 'Gault,' and 'Flysch,' whose affinities are doubtful, will be figured separately in the preparatory work; so that they can finally be joined either to the upper or lower formation, according to the decision reached by the commission of nomenclature.

INDIAN RELICS FROM NEW BRUNSWICK.

THOUGH Indian relics of the ordinary type, such as arrow-heads, axes, gouges, celts, etc., are of common occurrence in this region, as elsewhere, it is extremely rare to find any articles showing other features than those of mere utility; while remains of pottery, so far as I am aware, have, until recently, been entirely unknown. During the last summer, however, my attention was directed to a locality which is one of some interest, not only as containing undoubted relics of this character, but also as illustrating a somewhat unusual mode of occurrence.

The locality in question is that of a small stream or 'thoroughfare' connecting two sheets of water known as Grand and Maquapit Lakes, being the two principal members of a series of lakes and streams covering a considerable area in the central coal-basin of New Brunswick, and tributary to the river St. John. Both

shores of this thoroughfare are low, that intervening between it and the St. John being a mere marsh subject to overflow by the spring freshets; and it is in the soft muds forming the bank of the stream, and thus annually submerged, that the relics in question are obtained.

These are in the form of broken fragments of pottery, of which the largest obtained by me was about two by two and a half inches, and, although not sufficiently perfect to give any definite idea of the form or size of the vessels of which they once formed a part, reveal very clearly, by their composition, texture, and ornamentation, their true nature. As a rule, they are quite firm, looking as if made up of a granular admixture of clay and fine sand, through which, in many specimens, are scattered numerous and rather conspicuous fragments of a lustrous black mica; the whole being hardened, if not vitrified, by heat. The outer surface is usually covered with a reddish or dark-brown glaze, which is less coarse than the material beneath; and upon this surface are stamped or impressed numerous indentations variously arranged in series of parallel, forking, or decussating lines. In one instance only could any thing like definite form be recognized; this being a well-rounded rim, or margin, striped on either side, of what appears to have been a shallow hemispherical bowl, or basin, of some six inches in diameter. During the extreme low water of summer, such fragments may be readily obtained lying on the surface of the hardened mud-beds, but at other times are to be had only by wading.

With these remains of ancient pottery has been found a great variety of stone implements, some of exceptionally perfect design and workmanship, and in two instances elaborately ornamented; while at short distances along the shore, and laid bare by the ploughing action of the ice in spring, are small heaps of flint-chips of all shapes and sizes, with, not unfrequently, broken pebbles or bowlders of quartz from which these have been derived.

The locality is one eminently fitted by its position for the temporary or permanent occupation of the aboriginal tribes, giving easy access by water not only to the St. John River, but to an extensive lake-region, which must have abounded then, as it still does, in game of various descriptions. It has, indeed, been a favorite camping-ground with the natives ever since the time of the first settlement of the country by the Europeans. A curious instance of the contact of the two races has been observed in the finding, during the ploughing of a field, several feet below the surface and not far from the thoroughfare above described, of a large copper caldron, or kettle, evidently of French manufacture, but containing within, besides a quantity of moose-hide, a variety of colored glass beads, some arrow-heads, and a single human molar tooth.

L. W. Bailey.

Fredericton, N.B., March 4, 1883.

THE PROPERTIES OF CARDIAC MUSCLE, AND THE NATURE OF THE ACTION OF THE VAGUS NERVE UPON THE HEART.

We printed recently (Science, No. 2) an account of the researches of Engelmann upon the rhythmic properties of cardiac muscular tissue. Almost simultaneously with the appearance of Engelmann's paper, Gaskell read before the Cambridge (Eng.) philosophical society a communication on the same subject, which has since been published in the proceedings of the society (vol. iv. 277, 1882). Gaskell independently arrives at the same general conclusion as Engelmann in regard to the rhythmical properties of cardiac muscle, but adds much that is new on this and other points. Researches on the hearts of frogs and tortoises, previously published, had led him to the following conclusions: 1°, The beats of the heart represent peristaltic contractions, which start at the venous sinus, and thence travel over the heart; 2°, The peristaltic nature of these contractions is obscured by the fact, that the wave of contraction passes along a tube which is not of the same calibre or of the same properties throughout, consequently the systoles of certain parts (auricles, ventricles) which have bulged out and become prominent, or which by differentiation of structure in the course of development have gained the power of more rapid or forcible contraction, being most conspicuous, give the impression of separate and successive contractions; 3°, Between sinus and auricle, and auricle and ventricle, in these animals, is a connecting band of muscular tissue of feeble contractility and slow conductivity. A systole started in the sinus is thus separated by an apparent interval from the auricular contraction, and this in turn from the ventricular. Gaskell had further proved that one could artificially produce in any region of the heart a zone of slow conductivity, corresponding to the natural sino-auricular or auriculo-ventricular boundaries. If a clamp, for example, be closed not too tightly around the ventricle, then a pause occurs between the contraction of the base and of the apex of that division of the heart. In the tortoise, one then gets, added to the usual succeeding phases of the heart-beat, sinus systole, auricle systole, ventricle systole, — an additional one, due to the separation of the ventricular systole into two distinct contractions, — one of its base, followed, after an interval, by that of the apex. If the clamp be still further tightened, only one contraction of each pair exhibited by the base passes on to the apex of the ventricle; on further tightening, one in three, one in four, and so on, until the block caused by the clamp becomes complete.

The above experiment serving to show how easily, by differences in the conductivity of certain zones of the heart, a primitively continuous peristalsis may be turned into apparently distinct beats of various regions, each separated by an interval from that of the heart-chamber preceding it, the question arises, What is the source of the primitive contraction starting from the venous sinus? Does it lie in nerve-cells, or in the possession by the sinus of muscular fibres, which have a greater tendency than those elsewhere in the heart to exhibit apparently spontaneous rhythmic contractions? Observations on the heart of the tortoise strongly support the latter view, as they show that any section of the heart will, if left to itself, sooner or later contract automatically; the difference in this regard between the venous sinus and the tip of the ventricle is one of degree, and not of kind. The isolated sinus begins beating at once, the auricle a little later, the ventricle later still, and a strip cut out of the tip of the latter only after about four hours. Once the beats in any division commence, they become rapidly more and more regular and powerful, and then continue uniformly for, in some cases, more than twenty-four hours. These facts seem to show that all parts of the tortoise-heart are spontaneously rhythmically contractile, but that the spontaneity is most marked in the sinus, and less and less prominent as the apex of the ventricle is approached. The latter, however, contains no ganglion-cells; and, as we can pass back by gradual steps from its properties to those of the

sinus, it seems pretty certain that the systoles of that part are also primarily due to its muscular tissue, and not to the nerve-cells in it. Recent researches seem to show that all contractile tissue has primitively a tendency to contract rhythmically; and we may perhaps regard the phenomena above described as due to a greater retention of this property in the muscle-fibres of the venous sinus of the tortoise-heart, as compared with those of the ventricles, which have been so modified for the purpose of rapid and powerful contraction as to interfere with the manifestation of the fundamentally inherent tendency to exhibit so-called spontaneous rhythmical beats.

The concluding portion of Gaskell's paper is concerned with the action of a weak, interrupted current upon certain functions of the cardiac muscle, and its resemblance to the action of the vagus nerve. He had already proved, so far as the frog is concerned, that stimulation of the vagus might, under various circumstances, produce directly opposite results, which may be arranged in pairs. It may cause, 1°, Slowing or acceleration of the rhythm; 2°, Diminution or increase of the force of the contractions; 3°, Diminution or (possibly) increase of tone. From subsequent work with the tortoise-heart, he now adds, 4°, Diminution or increase of conductivity in the cardiac muscle. As a corollary to the latter, is to be added the influence of vagus stimulation upon sequence of beats in the successive heart-cavities. When an artificial hindrance to conduction in the cardiac muscle (as by clamping) is interposed, vagus stimulation may either entirely check the transmission of the wave of contraction, or may facilitate it; and similarly it may shorten or lengthen the time-intervals between the contractions of successive heart-chambers. The initial effect of vagus stimulation is often to depress some function: its final and most enduring power is to exalt, intensify, and repair that function. It slows rhythm, but its stimulation makes rhythmic beats last longer than they otherwise would. It diminishes at first the force of the contractions, but its ultimate effect is to improve and sustain the contractile force. It may primarily diminish conductive power, yet in the end it completely restores that power. Gaskell concludes that *the vagus is essentially the trophic nerve of the heart.*

All the above results of vagus stimulation are repeated exactly when an interrupted current not powerful enough to cause contractions is sent through an isolated strip of the apex of the ventricle of the heart of the tortoise. Further: atropine applied to this strip prevents the action of the interrupted current upon it, just as this drug prevents the action of the vagus upon the whole heart. Since the strip contains no nerve-cells, the interrupted current must act directly upon the muscular tissue. Hence it is made probable that the vagus nerve also immediately influences the cardiac muscle without any necessary intervention of nerve-cells; and also that atropine exerts its well-known influence upon the heart, not, as has hitherto been generally assumed, by acting upon the ganglia in that organ, but by immediately influencing the properties of its muscular tissue.

H. NEWELL MARTIN.

THERMOMETER EXPOSURE.

SOME may have been misled by a note on thermometer exposures of the signal-service, which appeared on p. 156 of SCIENCE. The subject is by no means so simple as that note would seem to indicate. Results of temperatures observed in the same neighborhood vary greatly. That the heat of a city, caused by the burning of coal for heating and manufacturing purposes, can affect the temperature of the air an appreciable amount, will be seen to be hardly tenable when it is considered that a breeze of five to ten miles per hour (which is a very light one) will entirely remove the air in the city each hour; that the number of flues by which the heated air is carried out is exceedingly small as compared with the whole atmosphere over the city; lastly, that reliable observations taken in the city and adjacent country show that no such effect is noticeable. Of the last, any one can satisfy himself by consulting observations made in Central-Park observatory and the Signal-office in New-York City. Both of these observatories are fitted up with the very best instruments, and the records may be regarded as reliable as any in the country. The observations for 1878 for the first-named station have been published in the annual report of the New-York meteorological observatory, and, for the second station, in the reports of the chief signal-officer for 1878 and 1879. The following figures show maximum and minimum temperatures for each month of 1878: —

1878.	MAXIMUM.		MINIMUM.	
	Central Park.	Signal-Office.	Central Park.	Signal-Office.
January . .	51°	51°	7°	9°
February .	56°	57°	7°	10°
March . . .	69°	68°	13°	13°
April . . .	76°	75°	42°	40°
May . . .	84°	81°	40°	41°
June . . .	89°	88°	49°	47°
July . . .	94°	94°	63°	61°
August . .	90°	85°	50°	50°
September .	90°	86°	45°	45°
October . .	80°	78°	39°	39°
November .	60°	59°	29°	28°
December .	60°	58°	13°	12°
Mean . . .	74.9°	73.6°	33.8°	33.7°

When it is considered that these stations are in such diverse surroundings, with different exposures of instruments, and widely different positions as respects the sea, the above agreements can but appear very remarkable. Abundant similar facts may be easily found. Undoubtedly there are great differences of temperature in the same city or village, due to currents of cold air coming down valleys, differences of exposure of instruments, proximity to large bodies of water, and innumerable other causes exceedingly difficult to guard against. If any one has a doubt as to the uniform results obtained by the signal-service, a glance at the weather-map any day will convince him that isotherms can readily be drawn by using the observations made by the service. If it be claimed that these temperatures on the Atlantic seaboard are too high, it will, at the same time, be seen that this is due in large measure to the proximity of the cities to the sea; and it is necessary to establish the stations there to meet the needs of seafaring men. Experiments are being carried on in England in order to determine the proper manner of exposure of thermometers. Certainly the continental method of placing thermometers at four feet from the ground will hardly give proper temperatures in the spring and autumn in the northern United States so long as there is snow on the ground. What are needed are definite results from careful observations, and not indefinite or general expressions.

LETTERS TO THE EDITOR.

Cracking in ice.

I NOTICED recently a peculiar cracking in ice. Snow had fallen to the depth of about a foot, and had been followed by a cold rain; so that the snow was covered with a layer of ice about three-quarters of an inch thick. The snow immediately under the ice was more firmly packed than that farther down; so that pieces broken out had their under-surfaces covered to a depth of about three inches with closely-packed snow.

The cracks seemed to run over the field irregularly, without regard to the conformation of the surface. In one or two cases they seemed to have a 'radiant' point in a bunch of thistles. Their peculiarity was in the fact, that, for a great part of their extent, they were almost perfect sinusoid curves. Where a crack began, or joined another, it would run quite straight for ten or twelve feet; and then the curves would commence. Most of the curves were of the same size,—about three feet and a half from crest to crest. The two edges of the ice where the crack was were separated about a quarter of an inch to half an inch, and one was uniformly a little higher than the other.

JACOB REIGHARD.

La Porte, Ind., Feb. 10.

Caterpillars eaten by a kitten.

One of our beautiful springs was sadly rifled of beauty and comfort by severe inroads of insects. Elms of noble promise hung around my lawns chiefly as chandeliers for the constant descent of canker-worms. Following the gardener, a pet kitten was attracted by this novel harvest. She ate the caterpillars with infinite relish; and so long as canker-worms hung from the trees, so long did the kitten pass her time in constant leaping after the pendant worms. Among my birds, only my little Black-cap was her rival in rapid voracity. Fed by them as gathered *in bowls*, the mocking-bird was not to be named in comparison with either. M. C. SPARKS.

Badly crystallized wrought iron.

This seems to be such a condition of affairs as is pointed out by Mr. Kirkaldy, who shows that a crystalline fracture is not an indication of the strength of material, but simply of the way in which rupture is effected. A sudden fracture always shows crystalline constitution. In the broken walking-beam referred to by Mr. T. M. Clark (p. 169), the exterior layers doubtless yielded gradually, and the interior layers suddenly; which accounts for the crystalline appearance in the latter case, and the fibrous appearance in the former. I think similar cases will be found reported in Mr. Kirkaldy's excellent work. C. S.

Radiant heat, and the second law of thermodynamics.

The application made by Prof. J. W. Gibbs of the doctrine of radiation (SCIENCE, p. 160) would seem to me in all points to be correct, were it not really a question of the composition of velocities, of which no sufficient account seems to be taken.

To make this clear, suppose a body (such, for example, as a right cylinder) to be projected lengthwise in empty space of uniform temperature, with a velocity equal to that of radiant heat. No heat can then overtake its rear surface: hence its front will receive a double amount, and so have its temperature augmented; thus causing heat to flow along the cylinder from front to rear. But any disturbance of temperatures, such as this, is in apparent contradiction to the proposed application of the doctrine of radiations, which attempts to prove in general that no changes of temperature can arise from the motions of bodies. It is not quite certain that this would also constitute an exception to the second law, although it may well do so, because the radiations encountered may possibly cause a pressure upon the front surface; though it is difficult to see how this can be so in case it is entirely black. This illustration, then, which needs more complete discussion, will at least serve to make evident the necessity of taking into account the velocities of moving bodies in cases in which no such pressures oppose their motion. This is what has been attempted in the brief computation contained in the original paper;[1] and it seems to be admitted, in so far as direct exchanges of radiant heat between A and B are concerned, that more is transmitted in one direction along a line of apertures, *a c b*, than in the other.

Now, suppose the screens to be non-conducting, and enclosed by a non-conducting cylindrical surface; also let the entire interior of the cylinder and screens be perfectly reflecting. Then no part of the interior can be a continuous source of radiant heat. The enclosed space is also excluded from exchanges with all bodies except A and B, and these only exchange heat through apertures in the screens.

It appears possible, by suitable reflectors moving with the screens, to return to A and B respectively all heat radiated from each which does not pass through the screen *c*. Now, if a less amount of heat pass in one direction through the apertures *a c b* than in the other, then, in order that equilibrium may continue, more heat must pass through *c* along other lines. But, as there are no sources of heat in the interior, this cannot continue, although true at the start. It is therefore sufficient, in attempting to establish the proposed process as an exception to the second law, to show, as has been attempted, that more heat is transmitted directly from A to B than from B to A; since their exchanges with other bodies and parts of the apparatus may be left out of the account, as was tacitly assumed in the original paper. H. T. EDDY.

Keweenaw-point geology.

On account of certain statements in Prof. R. D. Irving's letter in SCIENCE, March 9, it seems proper to attempt to undeceive him regarding the position of some geologists towards the evidence of the Wisconsin survey, and to make clearer to others the points of discussion. That evidence has neither been ignored nor denied by them; but, while willing to grant its correctness, they deny the conclusions that Irving and his associates have drawn therefrom. Foster and Whitney, in 1850, clearly showed that the copper-bearing traps were a series of lava-flows, between which, in many places, were conglomerate and sandstone beds, composed, in part, of the *débris* of the underlying lava. These detrital deposits were laid down on one lava-flow, and then the succeeding flow was poured over all. Later, Mr. A. R. Marvine brought forward full evidence of the same kind. The present writer also collected similar proof, and, in addition, showed that the traps overflowed and indurated the eastern sandstone.

The structure of the district along a line extending obliquely from Torch Lake to Copper Falls, across the eastern trappean belt, and uniting the sandstone on both sides, is as follows: On the eastern side of Keweenaw Point a series of sandstone and conglomerate beds was laid down, having a gentle but increasing dip as the traps are approached; over these poured the first lava-flow, indurating the underlying

[1] Journ. Frankl. inst., March.

sandstone; this lava was partially denuded, and buried under a conglomerate composed of its *débris*, mingled with rhyolitic, trachytic, and granitic material. The detritus was also buried under another lava-flow; and this alternating action went on, first with increasing and then with diminishing eruptive activity, until the western sandstones and conglomerates were reached, which were laid down on the last lava-flow. It is probable the lava came from fissure eruptions. Wherever the detritus was deposited on the lava, whether within the trappean belt or on its western side, denudation has taken place, and fragments of the trap (melaphyr and diabase) have been enclosed in the overlying detritus. Unconformability would, of course, thus exist, and the writer has figured such a case; but it is the unconformability that always exists when lava flows on a shore, and is subjected to the denuding action of the waves, and proves nothing regarding the geological age.

The evidence which Irving claims has been ignored, and which he says is "proof absolute that the Keweenawan [copper-bearing rocks] series belongs below the base [Potsdam] of the paleozoic column of the Mississippi" (*Geol. Wisc.*, iii. 23), is principally the finding of a trappean rock at Taylor's Falls, against which rest sandstone and shales holding fragments of the trap and primordial fossils. Excepting the fossils, these are exactly the conditions which are found, and which ought to be found, within the copper-bearing belt, and on its western side; and it proves nothing regarding geological age, but only sequence of time. If such evidence as this is 'proof absolute' of distinct geological age, then there is proof absolute that there are as many different geological formations in the copper-bearing rocks as there are detrital beds enclosed in the traps, and proof that the last lava-flow of any active volcano, reaching the sea, is separated by a distinct age and 'immense unconformity' from the detritus deposited upon it before it is hardly cold. Unconformity of itself proves nothing, unless both formations are sedimentary; for an eruptive rock cannot, from the very nature of the case, be conformable, in the true sense, with any thing. The relations that the old basaltic lavas have, according to Irving, to the western sandstone, are exactly what they ought to have from their origin, as shown thirty-three years ago.

Again: according to the Wisconsin geologists, the Taylor's-falls trap is fifteen miles from any other so-called copper-bearing rocks, and may as well be an azoic rock; for similar ones have been collected by the writer in the granite of the Marquette azoic district. If it is referred to the copper rocks on lithological grounds, the same argument could be used to unite with this series a large part of the basaltic traps the world over. The resemblance between them is, in the writer's opinion, that which any two basaltic lava-flows or dikes have wherever they may have been extruded.

The writer has shown that the first trap on the east overflowed and indurated the eastern sandstone; and he collected specimens showing the induration, the trap, and the trappean detritus in the overlying conglomerate. Therefore Irving's statements, that the eastern sandstone unconformably overlies the trap, and that no trappean detritus occurs in the fragmental rocks, are incorrect; and the published evidence was in his hands several years ago. Irving is mistaken when he says that all the geologists who approached the question from the east felt baffled, as the writings of Foster and Whitney, Selwyn, or myself, give no indications of the kind. It may be mentioned, that in 1850 Foster and Whitney showed that a fault existed along part, at least, of the eastern side of the traps, and that the Bohemian range was a later protrusion. This evidence will explain the apparent unconformity of the traps with the eastern sandstone observed in some places.

For a fuller discussion of the copper-bearing rocks and allied formations, together with the literature down to 1880, the writer would refer to the bulletin of this museum, vol. vii. pp. 1–157.

M. E. WADSWORTH.

Museum of comp. zoöl., Cambridge, Mass., March 15, 1883.

Domestic ducks that fly abroad like pigeons.

In response to Mr. Storer's note under the above heading (SCIENCE, No. 3), I would state that in my boyhood I lived on a plantation in Liberty County, Ga., on which there were a great many domesticated ducks, both mallards and musk-ducks. Many of these latter belonged to the negroes, and were tended with but little care. Near by the negro village there was a swamp full of large trees, and often covered with water. A considerable portion of the swamp was cleared, and annually planted in rice; but many dead cypress (Taxodium) trees still remained standing. This swamp was a favorite resort for wild ducks of all kinds, especially mallards, teal, and summer ducks (wood-ducks). Many domesticated musk-ducks, especially those belonging to the negroes, flew abroad every morning, remained in the swamp (one to two miles distant) all day, and returned at night. Some of them built their nests and reared their young in the swamp, though they never became thoroughly wild.

I never observed this habit, except in the musk-duck. The reason, I think, is plain. In shape, in gait, in flight, and in habits, the musk-duck is very similar to the wood-duck (sponsa). Like the latter, it walks with freer step, it rises, flies, and alights with greater ease and grace, than other species, because the wings are broader and rounder. Like the wood-duck, also, it alights on trees. The dead cypress-trees were a favorite resting-place for the musk-ducks. Like the wood-duck, too, it builds its nest on trees or stumps, and takes down the young when hatched. I have never known the musk-duck to build on the tops of tall cypresses, like the wood-duck, but often on the tops of hollow stumps fifteen to twenty feet high.

JOSEPH LECONTE.

Berkeley, Cal., March 15.

Apparent attractions and repulsions of small floating bodies.

To obviate possible misunderstandings, it may be proper for me to make a few remarks in relation to 'E. H. H.'s' *critique* (SCIENCE, i., p. 43) on my article (*Amer. journ. sc.*, Dec., 1882) on the above phenomena.

I am to blame for whatever ambiguity attaches to the use of the term 'tension' as applied to the explanation of these phenomena. In one instance (that cited) I inadvertently used the expression 'superior *tension*' instead of 'superior *force*.' But inasmuch as in the formal announcement of the capillary principle — which is applied to the case in question, and also in the preceding as well as the succeeding context — it is very clearly indicated that the effective capillary forces (and not the *surface-tension*) are regarded as inversely proportional to the radii of curvature of the meniscuses, few physicists will, I trust, be misled by the expression.

He does not admit "that a liquid film tends to draw a solid, to which it is attached, toward the centre

of concavity of the film." The most simple and satisfactory proofs of the relative efficiency, as well as the *direction*, of the resultant of these capillary forces, are to be found in the well-known contrary movements of small columns of water and of mercury, when introduced into conical capillary glass tubes placed horizontally. In these cases it is evident, that the effective forces are inversely as the radii of curvature of the terminal meniscuses, and are directed toward their respective centres of concavity.

He maintains, that, if the capillary forces were directed toward the centre of concavity of the film, "the tendency of a column of water raised between two floating bodies by surface-tension would be to lift those bodies: similarly, a column of liquid sustained in a fine tube would tend to lift the tube." Simple mechanical considerations are sufficient to show that he is mistaken in supposing that such a result would follow. Indeed, it is obvious that the elastic reaction of the common meniscus, formed when two such floating bodies are brought near to one another, *does not tend to lift them;* for the *vertical* component of the capillary forces, directed toward the centre of concavity, is exactly counterbalanced by the weight of the adhering liquid elevated between them, while the *horizontal* component is free to draw them together.

So, likewise, the column of liquid sustained in a capillary tube can have no tendency to 'lift the tube;' for it is evident that the weight of the liquid elevated must exactly balance the vertical component of the capillary forces acting at the crowning meniscus within the tube: the horizontal component tends to draw the sides of the tube together.

It is freely admitted that my explanation of this class of phenomena may be imperfect, and may be more or less unsatisfactory; but it seems to me that its shortcomings are not to be found in the directions indicated by the objections put on record by the critic. Such elementary facts as have been elicited above could not appropriately find a place in my paper.

After all, however, the simplest method of reducing this class of phenomena to the reaction of elastic films of liquids is the application (as has been done near the close of my paper) of the principle of Gauss; viz., that this reaction "always tends to reduce the surface to the smallest area which can be enclosed by its actual boundary." JOHN LECONTE.

Berkeley, Cal., March 16, 1883.

A new lecture experiment.

It has long been known, that an iron bar may be permanently magnetized by holding it in the direction of the dipping-needle, and striking it a blow with a hammer. The novelty of this experiment, so far as I am aware, consists in indicating the magnetization of the bar at the instant the blow is delivered. I use for the purpose a reflecting galvanometer (Kohlrausch's pattern), a lantern with detached lens for focusing the reflected beam (or, in the day-time, a *porte lumière*), a piece of gas-pipe 80 cm. long and 45 mm. diameter, and a coil of fine wire large enough to slip freely over the gas-pipe. After carefully demagnetizing the gas-pipe, the coil of wire is connected with the galvanometer, and slipped down against the hand, holding the pipe about 30 cm. from the upper end. With the pipe pointing in the direction of the dipping-needle, a ringing blow is struck on its upper end, and the spot of light on the screen moves promptly from two to four feet, according to the distance of the screen from the galvanometer. A second blow produces only a very small movement compared with the first one. Reversing the gas-pipe, and again striking it, the change of magnetism is indicated by another induced current about equal to the first. The direction of the current is the same as is obtained by moving the coil from the end struck toward the middle of the pipe. By moving the coil along the pipe, before the blow and after it, the induced currents indicate that the temporary magnetism of the pipe produced by terrestrial induction is much weaker than the permanent magnetism produced by the blow. H. S. CARHART.

North-western university,
March 20, 1883.

HOUGHTON FARM EXPERIMENTS.

Houghton Farm. Experiments with Indian corn, 1880–81, with a summary of the experiments with wheat for forty years, at Rothamsted. Cambridge, *Riverside pr.*, 1882. 75 p. l. 8°.

——— *Agricultural physics. Series i. Nos. 1, 2. Meteorology and soil-temperatures.* By D. P. PENHALLOW, B.S. Newburgh, *Ritchie & Hull, pr.* [1883.] 57 p., 5 pl. l. 8°.

BESIDES the intrinsic value which these publications have as reports of carefully conducted experiments, they possess additional interest to all who have at heart the advancement of scientific agriculture in this country, because they are the first public reports of what is here a novel undertaking. The proprietor of Houghton Farm, Mr. Lawson Valentine of New York, has, in effect, established upon it an experiment-station devoted to the scientific investigation of agricultural questions. So far as we are aware, this is the first institution of the kind in the country supported by private munificence, and hence untrammelled by the demand for results of immediate practical utility, and by the mass of miscellaneous chemical work which seriously circumscribes the scientific activity of public experiment-stations. The outcome of this form of the 'endowment of research' will therefore be awaited with much interest.

The first of these reports gives an account of the field-experiments with Indian corn, executed by Dr. Manly Miles in 1880 and 1881. These experiments are, in the main, modelled after the famous Rothamsted experiments of Lawes and Gilbert, and are to be continued through a series of years, with the design of doing for Indian corn what the English experiments have done for wheat and barley. The experimental plots having been laid out and drained in the previous year, a crop of corn was grown in 1880 *without manure*, in order to test the uniformity of the soil and establish a basis for subsequent comparisons. This was followed in 1881 by a crop to which various kinds and quantities of manures were applied on the several plots, certain plots being left unmanured for comparison.

Unfortunately the season of 1881 was extremely dry, and the manures applied produced scarcely any appreciable effect; so that, although various minor results of interest and value were obtained, the main object of the experiments was scarcely at all advanced by the year's work. The most interesting of these minor results is, perhaps, the striking and beneficial effect exercised on the yield of some of the plots by the thorough drainage which they received. Barnyard manure was the only fertilizer which produced any noticeable effect; and this is ascribed rather to its physical action in making the soil more retentive of water than to any direct fertilizing action.

It is evident that circumstances have conspired to render this simply a preliminary report, whose value consists in its account of the plan and methods of the experiments more than in any results yet attained.

Dr. Miles appears to be fully aware of the complex nature of the problems attacked, and to have taken great care to execute all the operations of tillage, planting, cultivation, and harvesting in a uniform manner on the several plots. He is cautious, too, in drawing conclusions, and not in haste to attribute small difference of yield to the effects of different fertilizers, as is too often the case.

His method of comparing the yields of a manured and an unmanured plot is novel and interesting. Instead of assuming the difference between the two to represent the effect of the manures, as is usually done, he first grows a crop on all the plots without manure. In the crop of the succeeding year, he first notes the gain or loss of yield on the unmanured plot, and then assumes, that, if the plot to be compared had not been manured, its yield would have varied to the same extent. Then the difference between the actual yield of the plot and what it would have yielded without manure is regarded as the effect of the fertilizers applied to it. The following example illustrates the method: —

	Manure in 1881.	Yield 1880, unmanured.	Yield 1881.	Would have yielded without manure.	Gain due to manure.
Plot 1 . .	Muriate of potash .	27.1	43.5	36.2	7.3
Plot 3 . .	Nothing .	28.1	37.2	37.2	-

This method of comparison is evidently intended to take account of the natural unevenness of the soil, and it is to a certain extent an improvement over the direct comparison of yields; but it also involves errors of its own, and not only that, but errors of *unknown amount*. Because plot 3 yielded one bushel per acre more than plot 1 in 1880, it is by no means certain, that, in the very different season of 1881, the same difference would have been observed: indeed, it is highly probable that it would not have been. Dr. Miles recognizes this, and designates the 7.3 bushels of our table as 'probable increase produced by manures.' But he gives us no means of knowing whether this amount is within or without the limits of error; that is, whether the manure on plot 1 actually did produce an effect or not. This cannot but be regarded as a serious deficiency in these otherwise valuable experiments; and it is one that no care in the execution of the experiments can do any thing to remove.

A field-experiment with fertilizers involves one of two assumptions, — either that the several plots have exactly the same crop-producing power, or that the differences observed in a preliminary unmanured crop are constant. Neither of these assumptions is true. With the greatest care in the selection of plots, very considerable differences in both respects will show themselves. Such being the case, the scientific conduct of a field-experiment requires that the amount of error involved in the above assumptions shall be determined, to the end that we may know whether the apparent differences in the effects of the fertilizers have any real significance. This may be done by multiplying the number of plots which receive the same treatment, and distributing them uniformly over the experimental field; the only limit to the multiplication being that imposed by practical considerations of the possibility of treating a large number of plots.

In this way it is possible to obtain, not only the average yield of a certain fraction of an acre under particular treatment, but the amount of variation from that average which may be expected in individual cases. This method calls for a multiplication of the manured, as well as of the unmanured plots: it greatly increases the labor of conducting a field-experiment; but the results, once obtained, are reasonably accurate, and *we know how accurate they are.*

This whole subject has recently been very thoroughly discussed by Wagner; and a perusal of his papers[1] cannot fail to be in the highest degree interesting and suggestive to all who contemplate making field-experiments.

[1] *Journal für landwirthschaft*, xxviii. 9; *Landw. versuchsstationen*, xxviii. 123.

The account of the Rothamsted experiments on wheat, from the pen of Mr. Lawes, which is appended to the report, will be read with special interest, as showing what important gains to our knowledge may result from such experiments as those initiated at Houghton Farm.

The papers on agricultural physics contained in the second report relate to local meteorology and soil-temperatures. Under the first of these subdivisions the most interesting statement is, that local predictions, based on the signal-service and on local observations, were made at noon for the succeeding twenty-four hours, with only two per cent of error. Confidence in them was established, and they served an important purpose for the time during which they were issued. The observations on soil-temperatures will, of course, yield more trustworthy averages when based on more than a single season's work; but results of value are already obtained. Eight thermometers with the bulbs immersed in oil within wooden cases, to prevent change of record during their observation, were placed at the surface, and at depths of three, six, and nine inches, and one, three, five, and eight feet, and were observed hourly between seven A.M. and nine P.M., from May to October, 1882, and sometimes throughout the twenty-four hours. The soil was gravel upon hardpan and clay. The observations are elaborately discussed by Mr. Penhallow, who obtains the following results. The penetration of the surface-heat to a depth of three inches requires one and a half to two hours; to one foot, eight to ten hours: hence, at a little greater depth than the latter, the diurnal waves of temperature would be reversed. Hourly change of temperature ceases at about eighteen inches, and daily, near eight feet; but these, as well as the average daily variations, being only for the hours from seven A.M. to seven P.M., need supplementary observations to show their full measure. The use of minimum thermometers would greatly increase the value of the results. Irregularities in the daily temperature-curve are considered first as shown in a diminished total variation ('mean depression of hourly variations'), and, second, as seen in marked irregularities in the curve ('sudden depressions'). The first of these is found to be always connected with rainfall and consequent excess of moisture in the soil, probably aided by absence of direct sunshine; the second generally comes either from a temporary obscuration of the sun, as by a passing cloud, or about as frequently from the reaction after a sudden rise of surface-temperature much above that of the soil below.

Of more interest are the comparative results of observations made in June, three inches below the surface, in one uncultivated, and two plots of cultivated ground, referred to in the report as *a* and *b*. One of the cultivated plots, *a*, had been treated with composted stable-manure; the other, *b*, with an equivalent mixture of commercial fertilizer; and both were planted with corn. The uncultivated ground had the greatest daily range, chiefly from its higher maximum temperature; plot *a* had the least range, as its minimum was ½° to 1° C. higher than in plot *b*. This diminished variation would seem to result from heat evolved by the decomposing manure.

All the observations are neatly recorded in tables and diagrams. Their only inconvenience arises from the use of even numbers of feet or inches in determining the depths for observation, while the records are kept in fractional centimetres; so that 3, 6, and 9 inches are always rendered 7.6, 15.2 and 22.8 cm. One system or the other should be fully adopted. As the first season of observation includes only the warmer months, studies of frost are not yet published.

FOSSIL ALGAE.

Apropos des algues fossiles. Par le marquis de Saporta. Paris, *Masson*, 1882. 76 p., 10 pl. l. 4°.

In a fine imperial quarto, the author critically examines the nature of some impressions described by phytopaleontologists as remains of fossil Algae, but which a Swedish naturalist, Nathorst, in a considerable work published at Stockholm (1881), has considered as representing tracks of invertebrate animals. In his memoir, Nathorst illustrates by a large number of figures the tracks and impressions which the author himself and others have observed, as produced by the movements of small crabs, insects, worms, even of water-currents and waves, upon sand, or soft, muddy surfaces. As points of comparison, the Swedish author gives a list of the works where, to his belief, are represented so-called Algae corresponding to his figures. Among the memoirs quoted in the list are Saporta's *Paléontologie française* (vol. i.) — where, among the Jurassic plants, all the Algae, excepting Itieria and perhaps one or two others, are considered as true tracks — and the ***Evolution du règne végétal***, by Saporta and Marion, where most of the impressions described as Algae are regarded as tracks of divers kinds. It is to defend his

position, and that, indeed, of phytopaleontology, that Saporta has prepared a really noble volume. He first examines the conditions of the vegetable remains, their mode of preservation, the evidence of their vegetable nature compared with the impressions produced by animals or mechanical agency. On this subject he adds a note of Dr. Marion, who has followed the same line of research as Nathorst, in carefully studying the character of the cells produced by animal agency, and who points out the great difference between these tracks and vegetable impressions. The second part of Saporta's memoir contains a detailed examination of some types of fossil Algae. The species described are represented, as well as their living related types, with admirable care and precision. Some of the documents from which Saporta has derived valuable assistance are from the works or communications of American authors; Harlania Hallii, among others, is beautifully figured. With few exceptions, all the evidence adduced in the admirable work of Saporta is opposed to the opinions of Nathorst, and renders great service to phytopaleontology.

BOLTON'S QUANTITATIVE ANALYSIS.

The student's guide in quantitative analysis, intended as an aid to the study of Fresenius' system. By H. Carrington Bolton, Ph.D., Trinity college, Hartford, Conn. New York, *John Wiley & Sons*, 1882. 6 + 124 p. 8°.

The above title is somewhat misleading; for the book, as stated in the preface, is a series of notes on a system of quantitative analysis, as developed and modified by the author, from a course of instruction originally organized in the School of mines, Columbia college, by Prof. C. F. Chandler. Viewing the book in this light, two things must be taken into consideration, — first, whether the analyses given are typical ones, such as would enable the student, on the completion of the course, to work out by himself the common problems of quantitative analytical chemistry; second, whether the notes given under the various determinations are such as explain, not only the different steps of the process, but also the reasons that necessitate them. The first of these two questions we can answer decidedly in the affirmative. The only criticism that we might make is, that possibly too much attention has been paid to alloys, and not quite enough to complex mineral determinations. The first analysis given is baric chloride, then magnesic sulphate, and other simple salts where no process of separation is necessary. The book then takes up, in well-chosen order, almost all the common alloys and minerals, gives the simpler problems of volumetric work, the determination of carbon, hydrogen, and nitrogen in organic compounds, and many of the most striking commercial tests; such as the examination of sugar, milk, mineral-water, coal, and petroleum. The notes, however, under these different analyses, we cannot consider as perfectly satisfactory. They consist of a short account of the process, with references to Fresenius or the original article, and sometimes a tabulated plan; but no explanation of the various steps is given. If, after each analysis, the reasons why the different reagents had been added, and other numerous details, had been explained, the value of the book would have been much greater; for it is the want of such elucidations in Fresenius that makes his system seem confused and difficult to the young student. As a whole, however, when studied, as intended by the author, in connection with Johnson's translation of Fresenius, or when supplemented by a thorough series of lectures, we can recommend the book as giving a valuable course in quantitative work.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Encke's comet, and a resisting medium in space. — Dr. O. Backlund, in a paper entitled *Kurzer bericht ueber meine untersuchungen ueber die hypothese eines wiederstehenden mittels* (*Mélanges math. et astron.*, vi.), makes the following statement of the results of his researches on Encke's comet: "The investigations hitherto made of the theory of Encke's comet really prove nothing as to the existence of a resisting medium in space. Even if we should succeed by such a hypothesis to explain sufficiently the increase of the mean motion and the decrease of the eccentricity during the period 1819–48, a simple hypothesis like this will not at the same time suffice for the motion of the comet after 1865, as the variation of the mean motion after that time has most probably become different. Not until the period 1865–81, and its connection with the earlier one, have been fully discussed, will it perhaps become possible to find indications of the nature of the unknown forces which act on the comet." — (*Copernicus*, Feb.) D. P. T. [531

Selective absorption of solar energy. — Professor Langley publishes an extended, elaborate, and exceedingly important paper on the selective absorption of solar energy, as determined by observations with the spectro-bolometer at Allegheny observatory, and upon the summit of Mount Whitney. It consists mainly of a statement of results, with comparatively little detail, — perhaps in some cases not quite so much as would be desirable in order to enable the reader to judge how far the numerical conclusions are to be trusted, since probable errors are seldom given. Further papers are promised, however, in which these matters are to be more fully treated.

Prof. Langley's observations cover all the spectrum from about wave-length 0.″35 in the ultra-violet to 3.″00 in the infra-red, — far below the limit reached by any other investigator.

The principal results are the following: 1. The maximum of energy in the diffraction spectrum is near the luminous maximum between the red and yellow, though varying with the sun's altitude. 2. Our atmosphere produces an enormous systematic absorption, increasing continually from the infra-red extremity of the spectrum, where it is comparatively slight, to the ultra-violet, where it is very great. This, however, is not to be taken as denying the existence of remarkble absorption-bands in the infra-red. The observations, in fact, show *four* such bands at wave-lengths 0.″94, 1.″14, 1.″37, and 1.″83, each of them quite as remarkable as the great line A, near the lower extremity of the visible spectrum. 3. The character and color of the sunlight is markedly changed by the atmospheric absorption; so that, to the naked eye placed outside our air, the sun would appear decidedly bluish. 4. The solar constant indicated by the observations is even higher than Forbes's value: it rises to 2.84, and seems not unlikely to reach 3.00. (The units in which the solar constant is here expressed are not *calories* per square *metre* per *minute*, but ten-thousandths of a calory per square centimetre per minute.) 5. The apparatus used was so delicate that all the principal Fraunhofer lines of the visible spectrum showed themselves in the galvanometer readings. 6. The ratio of the luminous to the dark heat is greatly changed by the atmospheric absorption, being much greater outside our atmosphere than within it. The writer adds, "It is probable, however, that the solar spectrum before absorption, though probably weak below the red, *yet extended very much farther into the infra-red than our charts indicate.* We may even regard it as probable that some agent of the atmosphere acts as an almost complete barrier to the entrance or departure of rays below the point charted."

The salient features of the investigation are the exquisitely sensitive apparatus devised for its prosecution, and the new method of deducing the solar constant from pyrheliometer observations at the earth's surface by means of separate co-efficients of transmission determined for radiations of different wave-lengths.

An interesting question arises, also, as to the way in which our atmosphere acts to retain the sun's heat on the earth, in view of the observed fact, that, contrary to all previous suppositions, the air is more transparent to the red and infra-red rays than to those in the upper part of the spectrum. It would seem, as the author suggests, that the air must be almost opaque to rays of wave-lengths below some limit; that limit, however, being below the extreme point reached by his measures. — (*Amer. journ. sc.*, March.) C. A. Y. [532

MATHEMATICS.

Algebraical curves. — M. Noether seeks to establish a thoroughly rigorous foundation for the general theory of algebraical curves in space, and, to this end, proposes to investigate all of the fundamental properties of such curves as can be derived from the general theory of algebraical functions. References are given to the most important papers which have already appeared on this subject; and the author remarks that but two processes have been employed in these earlier papers. The first, developed principally by Cayley, depends upon the representation of these curves by a cone and a 'monoid:' the second seeks to apply the theory of algebraical functions directly to groups of points on the space-curve. The author uses both of these processes; founding them, however, upon firmly established and constantly valid theorems concerning algebraical functions, and shows that the first method, although leading to very general results, is not sufficient for a rigorous establishment of the entire theory. The limits of applicability of the second method are also indicated. The curves treated are without multiple points; and, since they are regarded as general intersections of surfaces, these surfaces can have no multiple points, nor can they have contact along a curve. The first part of the memoir treats of special cases of intersections of surfaces; and the second part, of the intersections of surfaces in general, these surfaces being conditioned only by the fact that they must contain the space-curve under consideration, be destitute of multiple-lines, etc. This general theory has inversely its most general application in the development of the geometry of special surfaces. A brief section is devoted to this latter subject, which the author proposes more fully to develop in a forthcoming paper. The present paper is undoubtedly a most important addition to the existing literature of algebraical space-curves. — (*Journ. reine und angew. math.*, xciii.) T. C. [533

Orthogonal surfaces. — M. Bianchi announces a theorem concerning certain triple systems of orthogonal surfaces; viz., all surfaces of constant negative curvature, $-\frac{1}{R^2}$, give rise to a triple system of orthogonal surfaces, of which one system is formed of surfaces having the same constant negative curvature, and the other two of surfaces which have circles of radius, R, as one of the systems of their lines of curvature. An application is given to the surface formed by the revolution of the tractrix; the Cartesian co-ordinates, x, y, z, of a point in the corresponding triply orthogonal surfaces, are given in terms of three parameters, u, v, w; and the method of generation of these surfaces is described. — (*Atti della r. acad. dei lincei*, vii.) T. C. [534

On Fuchsians. — M. Poincaré, in a series of memoirs presented to the French academy, has treated certain new functions, which he calls 'Fuchsians,' 'Kleinians,' 'theta-Fuchsians,' and 'zeta-Fuchsians.' These functions have a certain analogy to the elliptic and Abelian functions; viz., while these latter functions afford integrals of certain algebraic differentials, the new functions afford means of integrating linear differential equations with algebraic co-efficients. In the present paper the author merely introduces the subject by studying certain properties of Fuchsian groups (*groupes Fuchsiennes*), and expresses the intention of returning later to the study of their consequences from the point of view of the theory of functions. A fuller account of M. Poincaré's paper will be given later, the present brief notice being taken

from the *Probeheft* of the new mathematical journal edited by G. Mittag-Zeffler in Stockholm. — (*Acta math.*, i.) T. C. [535

Definite integrals. — M. Davidoff obtains two very general formulae, depending upon an arbitrary function F (χ) of the nth degree in χ. He claims, by aid of these, to be able to obtain nearly all of the known theorems concerning definite integrals, by making n infinite, and properly choosing the form of F (χ). Several applications are made, based upon the assumption of particular forms for F (χ). — (*Journ. de math.*, 1882.) T. C. [536

PHYSICS.

New method of determining specific gravity of solids. — Professor Munroe, having occasion to ascertain on shipboard the specific gravities of samples of coal, and being prevented by the motion of the vessel from using the balance, devised a procedure which not merely served his purpose, but is susceptible of wide application. Placing a block of coal in a liquid so dense as to float it, he gradually reduced the density by the admixture of a lighter liquid, until the coal *floated immersed*. The homogeneity of the mixture being maintained by stirring, this equilibrium was, of course, reached only when the specific gravity of the liquid became equal to that of the immersed solid. He then measured the specific gravity of the liquid with a common hydrometer. For the flotation of the lighter coals, he used a thick solution of cane-sugar; for anthracite, strong sulphuric acid.

As a test of the accuracy of the results, he afterward repeated the determinations with Jolly's balance, obtaining, —

	By Jolly's Balance.	By Mixture.	Difference.
Anthracite	1.5640	1.560	− .004
Bituminous coal	1.3008	1.310	+ .009
" "	1.3000	1.300	.000
" "	1.2790	1.285	+ .006
Cannel coal	1.1550	1.155	.000
" "	1.1292	1.120	− .009
Lignite	1.0909	1.090	− .001
Mean	. .	. .	± .004

(*Phil. soc. Wash.; meeting* March 24.) [537

Heat.

Domestic thermometry. — M. Gaston Tissandier considers the errors that are likely to be made in determining the temperature of a room by the usual method of a thermometer hung on the wall. He found that the apparent temperature of a closed room varied from 16° to 21.75°, according to the position of the thermometer. The air in the upper part of the room was much warmer than that near the floor, and the window had a very marked effect on the temperature of the air in its vicinity.

These observations were made with tested thermometers. The errors made with the ordinary domestic thermometer are, of course, much greater.

In order accurately to obtain the temperature of a room, M. Tissandier advises the thermometer to be held at the height of a man for about two minutes at several different points, and the mean of these observations to be taken. — (*La Nature*, No. 508.) C. B. P. [538

Electricity.

Determination of resistance-unit. — Lord Rayleigh recently read a paper before the Royal society, describing experiments conducted by him on the value of the B. A. unit of resistance. Three series of observations were taken, — two by Lorentz's method, and a third, in which the induction coils were separated from the disk so far that the result was practically independent of the radius of the coils. The mean value obtained was

$$1 \text{ B. A. unit} = .98677 \times 10^9 \text{ (C. G. S.)}.$$

The standard of time was a tuning-fork, whose absolute pitch was determined by a new method. — (*Electrician*, Feb. 10.) J. T. [539

Pressure and resistance in carbon. — S. Bidwell read a paper before the Royal society, giving the results of experiments on carbon cylinders making contact at right angles with each other. He proves that changes in pressure produce the greatest proportional effect when the pressure and strength of current is comparatively low; on the removal of the pressure, the resistance returns to about its original value. The passage of a current the strength of which does not exceed a certain limit causes a permanent diminution of the resistance. Similarly, the lessening of resistance due to pressure is magnified by the action of the current. — J. T. [540

ENGINEERING.

The Antwerp water-works. — Mr. William Anderson recently read a paper at the Institution of civil engineers in London, which contains some interesting facts in regard to the purification of water for domestic purposes. Antwerp has 200,000 inhabitants, and until recently its water was derived from shallow wells and from open canals. The well-water, though clear to look at, was for the most part dangerously contaminated by the sewage. The new works take the water from the Nèthe at a point eleven miles from Antwerp. This water was very impure, even after ordinary filtration through sand, as the river flowed through a highly cultivated country, carrying up the drainage of Malines on the flood-tide, and bringing down that of the villages on its upper waters on the ebb. The time during which water could be taken was thus limited to about three-quarters of an hour in each tide. Prof. Bischoff, Dr. Frankland, and Mr. Hatton had shown that finely divided metallic iron had the power of destroying organic impurities, removing color, separating finely suspended matter, and, above all, destroying the germs of putrefaction, of bacteria, and probably those of epidemic diseases. To confirm the laboratory evidence, a pair of filters with a total area of 680 square feet was made at Waelhem; the first filter being placed upon a higher level than the second, and filled with a bed of spongy iron and gravel, mixed in the proportion of one to three, covered with a layer of ordinary filter-sand. In this filter the water would become charged with iron, to eliminate which it was to be exposed to the air, and passed through a second or common sand-filter, in which the red oxide would be deposited. Three months of trial proved so satisfactory that three filters of the same kind were made, having an aggregate area of 31,000 feet, with three sand-filters of the same area. Eighteen months' work has shown that the water remains clear and bright, while the spongy iron showed no signs of deterioration. Dr. Frankland reports favorably upon the chemical condition of the water, and also upon the complete destruction of bacteria and their germs. — (*Van Nostrand's mag.*, March, 1883.) G. L. V. [541

Seasoning wood for musical instruments. — Mr. C. René of Stettin has devised a process for the drying of wood, intended especially for the prepara-

tion of wood for musical instruments, but perhaps otherwise useful. It is described as follows: —

The wooden boards are so arranged in a large iron kettle that gases may freely circulate over their entire surface, and exposed, in the first place, for twelve hours, to the drying effects of hot air. After this the kettle is closed, reheated by the apparatus below, and the air exhausted, when the kettle is filled with oxygen ozonized by electrical sparks passing continually between two points of platina, forming the end-poles of two wires conducted through tubes of glass into the kettle. The ozone is said to act so energetically upon the heated wood, that it consumes the destroying resinous, oily, or other parts in from twelve to twenty-four hours. — (*Engineers' club, Philad.; meeting* March 3.) [542

CHEMISTRY.

(*Organic.*)

Investigations on the unsaturated acids. — For the purpose of defining the lactone formation with greater precision, a series of investigations has been undertaken in Fittig's laboratory, which, although not completed, have yielded valuable results in this direction. By reduction of β-aceto- and β-aceto-isobutyric acids, Gottstein prepared two new caprolactones. A heptolactone was obtained by Young from the reduction of ethylacetopropionic acid, —

$$\begin{array}{l} CH_3-CO \quad COOH \\ \quad\quad | \quad\quad | \\ \quad\quad CH_2-CH-CH_2-CH_3 + H_2 = \\ CH_3-CH-O-CO \\ \quad\quad | \quad\quad\quad | \\ \quad\quad CH_2 - CH-CH_2-CH_3 \end{array} + H_2O.$$

An octolactone resulted from the reduction of methylethylacetosuccinic ether. Lactones were derived by Hjelt from allylmalonic, diallylmalonic, and diallylacetic acids. From the formation of paraconic acid from itabrompyrotartaric, it was shown by Beer to be a carboxylic acid of butyrolactone, —

$$\begin{array}{l} \quad\quad COOH \\ \quad\quad | \\ CH_2-CH-CH_2 \\ | \quad\quad\quad | \\ O \text{———} CO \end{array}$$

Other lactones of an interesting nature were prepared by Jayne and Penfield. Of special interest is a deltalactone obtained by Wolff. In lactones hitherto examined the general structure has been, —

$$\begin{array}{l} -C-CH_2-C- \\ | \quad\quad | \\ CO \text{——} O \end{array}$$

or reduction has taken place between the carboxyl group and a hydroxyl group attached to the third carbon atom from the carboxyl. Starting with sodium-acet-acetic-ether and β-iodpropionic acid, acetoglutaric ether —

$$\begin{array}{l} \quad\quad CH_3-CO \\ \quad\quad\quad | \\ C_2H_5-O-CO-CH-CH_2-CH_2-CO-OC_2H_5 \end{array}$$

— was first prepared. By treatment with hydrochloric acid this substance was converted into γ-aceto-butyric acid ($CH_3-CO-CH_2-CH_2-CH_2-COOH$), which, by the action of nascent hydrogen in alkaline solution, gave the deltalactone of normal capronic acid, —

$$\begin{array}{l} CH_3-CH-CH_2-CH_2-CH_2. \\ | \quad\quad\quad\quad\quad | \\ O \text{———————} CO \end{array}$$

Results obtained by Ebert in the study of cumarine, by Fittig and Ebert on cumarilic acid, and by Erdmann on the action of sulphuric acid upon cinnamic acid, were also described. — (*Ann. chem.*, ccxvi. 26.)
C. F. M. [543

Constitution of the nitroso-bodies. — The nitrosoketones discovered by V. Meyer in 1877 are now regarded by him and M. Ceresole as containing an oximido-group ($=N-OH$) instead of the group $-N=O$; for example, —

$$CH_3-CO-CH=N-OH$$

instead of

$$CH_3-CO-CH-NO.$$

Several facts are mentioned in support of the first form; and, as an experimental proof, the benzyl ether of nitrosoacetone was made and compared with the benzylnitrosoacetone obtained by the action of nitrous acid on benzylacetacetic ether. Since the isomerism of these bodies was established by differences in their physical and chemical properties, the first cannot contain a nitroso-group.

$$CH_3-CO-C\overset{NO}{\underset{H}{}}-C_7H_7.$$

Benzylnitrosoacetone from benzylacetacetic ether.

$$CH_3-CO-C=N\,.\,OH-C_7H_7.$$

Benzylnitrosoacetone from nitrosoacetone.

Whether nitrosoacetone contains the group $C=N-OH$ or the group $C\overset{\diagup\!\diagup NH}{\underset{\diagdown O}{|}}$ remains to be determined. The authors conclude that true nitroso-bodies are probably produced by nitrous acid when it acts on the group $\equiv CH$; when acting upon the group $=CH_2$, isonitroso-bodies containing the group $-C=N\,.\,OH$ result. — (*Berichte deutsch. chem. gesellsch.*, xv. 3067.) C. F. M. [544

GEOLOGY.

Geology of the vicinity of Havana. — Pedro Salterain y Legarra has published a geological map which shows along the Cuban shore, in the jurisdiction of Havana and Guanabacoa, a narrow strip of modern rocks; then a band twice as wide, which he refers to the miocene. Next to this is a band of about the same width, colored as eocene. The rest is represented as cretaceous, with narrow tongues of eruptive rocks running through it in a general east and west direction, the largest of which begins at Regla. Guanabacoa is situated on it, and it extends eastward to the limit of the jurisdiction. To the south-west, along the Rio Marianao, the cretaceous becomes very narrow; and south of and including Pedroso, the eocene again appears. The first part of the accompanying memoir consists of a brief orographic and hydrographic description of the districts, together with a number of analyses of the water of the Rio Almendares and of various mineral-springs.

Great difficulty was experienced, in studying the geology, from the heavy mantle of vegetable earth, and the consequent distance between outcrops. His classification of the formations is as follows: 1°. The quaternary or recent, containing the reef-formations of corals and zoophytes, detrital, and alluvial deposits. 2°. Post-pliocene, the relations of which to the quaternary or to the upper tertiary pliocene are uncertain. It generally consists of a sandy, whitish-yellow limestone, with many fossils generally identical with living species. In Matanzas a molar of a hippopotamus was found in a similar deposit. 3°. The miocene, which is placed between the overlying madreporic or quaternary and the eocene band. It extends along the northern slope of the first range of hills, and consists of a rock of generally identical character in all parts, a somewhat argillaceous white limestone, generally very fossiliferous, coarse, porous, and rough to the touch. Most of the fossils are casts. Zoophytes are abundant, as in the post-pliocene; but the relative

proportion of mollusks, principally lamellibranchiates, is larger. Echinoderms are also of more frequent occurrence. 4°. The eocene, the most important formation in the island, which serves as a point of departure of comparisons between the formations. It lies at the base of the miocene, and rests uncomformably on the very inclined and dislocated beds of an older system, probably cretaceous. It contributes chiefly to the formation of the first range of hills parallel to the coast. The upper part consists of fossiliferous limestones dipping 10°–12° N.W.; and below are various beds of clay and limestone. A cephalopod (Aturia zigzag Sow.) occurs, with a large number of gasteropods, lamellibranchiates, some echinoderms and corals, and many Orbitoides Mantelli. 5°. The cretaceous, in which no fossils are found. It underlies the tertiary and overlies the western group of mountains, which some geologists have considered jurassic. The general strike of its beds is east and west, and their dip about 50° S. or S.S.E. In this formation occur the numerous deposits of asphalt, which appear to be contemporaneous with certain igneous eruptions, none of which have affected the tertiary.

The eruptive rocks have been called 'Serpentinica formacion,' because serpentine is the prevailing rock in them. The characters of the rock are very variable. The serpentine is frequently associated with diallage, and yellowish-green olivine often abounds in the darker and more compact rock; there is also much oxide of iron and some oligist iron. The centre and highest part of the eruption is often occupied by diorite, then the olivine and diallage serpentine, and outside a talcose serpentine of brilliant lustre.

Lists of the fossils found in the miocene and eocene are given with the localities in which they occur.

M. Fernandez de Castro, in a lecture on the paleontological proofs that the island of Cuba was united to the American continent, says he believes that all the great geological divisions are represented in the island; but he adduces almost no evidence in support of this assertion. Those interested in the subject will find a bibliography of works relating to the geology of Cuba in vol. iii., p. 62. — (*Bol. com. mapa geol. España*, vii.) J. B. M. [545

METEOROLOGY.

Spectrum of the aurora. — Professor S. Lemström, chief of the Finnish meteorologic observatory at Lodan Kylä (lat. 67° 24′ N., long. 26° 36′ E.), has tried a novel experiment for determining practically the nature of the aurora. He placed a galvanic battery with conductors, covering an arc of 900 square metres (98 feet square), on the hill Oratunturi. He calls the arrangement a streaming apparatus. The conductors were constructed of uncovered copper wires, provided at each half-metre with fine erected points. The wire was led in slings to the top of the hill, and reposed on the usual telegraph-insulators. From one end of this wire a covered copper wire was conducted, on insulators, to the foot of the hill (600 feet high), and there joined a plate of zinc interred in the earth. In this circuit was put a galvanometer. Professor Lemström found the hilltop to be generally surrounded by a halo yellow-white in color, which faintly but perfectly yielded the auroral spectrum. This, he states, furnishes a direct proof of the electrical nature of the aurora, and opens a new field in the study of the physical condition of the earth. Further experiments in Enare, near Kultala, on the hill Pietarintunturi, confirm the above results. On Dec. 29, 1882, a straight beam of aurora was seen over the galvanic apparatus. — (*Nature*, Feb. 1.) H. A. H. [546

Meteorologic council of England. — There will be published soon, by the English meteorologic council, 'Contributions to our knowledge of the meteorology of the arctic regions.' These will consist of observations, taken almost entirely by British ships, from 1819 to 1873.

The council has also resolved upon obtaining data for synchronous weather-maps for the Atlantic Ocean for the thirteen months, August, 1882, to September, 1883, inclusive. [Charts for October, during the West-India hurricane season, would be an important addition.] The council publishes 78 per cent of its forecasts of wind and weather as verified. It has also instituted an investigation of the cause and character of London fogs, the best form of thermometer-screen, Stevenson's or Prof. Wild's metallic screen, the best manner of determining moisture in the air, and the motion of the upper air-currents. All these are still in progress. The latter experiments have been tried by firing six-pound shells with fuses of fourteen seconds. The vertical height reached before the explosion was 2,896m. (9,500 feet). The smoke cloud was clearly visible under a blue sky, and remained so for a considerable time.

The council has made inspections of all the first and second class stations. A noteworthy fact has been brought out by the inspector of the stations in England: namely, that at some stations the abnormal deviations of the wind-direction from local causes is very great; e.g., at Shields, the vane points 22° to the right of the true direction for all except south-west winds. — (*Rep. meteor. council Royal soc.*, 1882.) H. A. H. [547

PHYSICAL GEOGRAPHY.

The Gleisen valley, near Munich. — A recent study, by Chr. Gruber, of this dry valley in the Bavarian plain, shows its connection with the period of glacial extension from the Alps, down the valley of the Isar, to the line of morainal hills, when the overflow-streams from the melting ice cut out channels now abandoned. — (*Ausland*, 1883, 76, 87.) W. M. D. [548

Ice-caves. — Professor Fugger read an entertaining paper on ice-caves at the fourth international alpine congress at Salzburg last summer, in which he showed that the common idea of the summer growth and winter melting of the cave-ice is incorrect, although supported by high authority, as the elder Pictet, Murchison, Herschel, and others, and generally accepted in text-books. This error is doubtless based on the coolness of the caves in comparison with summer air, and their apparent warmth in the colder months, as well as on insufficient observations. Equally wrong is the view sometimes suggested, that the ice of caves survives from the glacial period. The grotto of La Baume, near Besançon, was known to contain ice in 1592; but in 1727 it was completely emptied by the duke of Lévi, to supply his army, encamped near by; yet in 1743 the bottom was covered again with ice, and a dozen ice-columns two metres high were formed. It is found by direct measure that the summer temperature of ice-caves is a little above freezing; but in winter it is several degrees below, the cold being derived from air that sinks in from the surface. Water trickles in at the temperature of the enclosing rocks, but is then soon frozen; and, if enough ice accumulates, it will last over the following summer season of melting. This is a simple and sufficient explanation. Summer evaporation has no effective share in producing cold, as the cavern air is very damp. Fifty-six ice-caves are known in the Alps, eight in the Jura and the Carpathians, four in middle Germany, and many more elsewhere.

None are known where the winter, or at least the January temperature, does not average below the freezing-point. The most important previous studies are by Thury, Sur les glacières naturelles (*Bibl. univ. Genève*, 1861), and by Browne, Ice-caves of France and Switzerland (1865). — (*Peterm. mitth.*, 1883, 12.) W. M. D. [549

GEOGRAPHY.

(*Arctic.*)

Notes from the north. — The Russian authorities have established meteorological stations at Mesen and Bereosoff in west Siberia. —— The international station at the mouth of the Lena reached its destination in August, and erected its dwelling on the island of Sagastir, with four observatories connected with it by covered pathways. —— The Russian *savant* Elisèieff is pursuing ethnological studies in Russian Lapland, and reports that there are not in that area more than three hundred individuals of the Lapp race. —— The 'Louise,' after unsuccessful attempts to carry a cargo to the Yenisei in 1881 and 1882, finally returned to Europe with the much-handled cargo, which had, part of the time, been stored at Hammerfest. For some time, at least, it is expected that the commerce of the Weser will flow preferably in any other direction than toward the Yenisei, if, indeed, these repeated failures do not put a quietus on trade by the Karagates. —— The results of the hydrographic investigations carried on during the voyage of the schooner 'Willem Barentz' are exhibited in the December number of the *Annalen der hydrographie* for 1883, by Bogoslavski. —— The 'Jeannette' survivors left Liverpool for New York on the 18th instant. —— A chart of the 'north polar lands' by Berghaus, with special reference to the work of the international polar commission, is on the point of publication by Justus Perthes. The stations will be represented in red, and the limits will extend to latitude 60°. The waters eastward from the Taimyr peninsula have received the name of the Nordenskiöld Sea from the author of the map, which will, as a matter of course, represent the latest researches, and, moreover, will be sold for the inconsiderable sum of one dollar. —— The Danish expedition in Greenland is to be commanded by Lieut. Holm, who will give two years to the work. —— Dr. Boas proceeded to the German station at Cumberland Inlet, with the meteorological party, in order to make a special study of the Innuit. —— Poliakoff, who went in the summer of 1881 to the island of Sakhalin to make collections and explorations for the St. Petersburg academy of sciences, passed most of the winter on the south-east coast, at Taranka, Patience Bay. Rich collections, and a part of his report, with maps, have already been received, and will soon be published. He will now proceed to the western shore of the Gulf of Tartary, and continue his investigations between Sakhalin and Vladivostok. —— An account of Dr. Stejneger's journey and observations in Kamtchatka and the Commander Islands of Bering Sea appears in *Naturen*, — a popular scientific monthly of Christiania, Norway. — W. H. D. [550

(*Europe.*)

Moors of Oldenburg. — The construction of canals through the moorlands of the duchy of Oldenburg has given much accurate information about them, which is summarized by chief inspector T. Schacht. Their area is 1,000 □ km. (about 400 □ miles) in a total surface of 5,376 □ km. The lower moors are perfectly level, and occupy depressions once filled with water. The upland moors are faintly undulating or slightly convex, sometimes climbing fifty feet above sea-level, and only occupy ground that has free drainage even at its lowest point. They begin at some moist locality with the growth of sphagnum, which, by its power of absorbing and holding moisture, spreads over the surrounding surface, and drives out the pre-existing vegetation. The thickness of these deposits sometimes reaches thirty feet. Great quantities of peat are taken from the moors, and hardly any other fuel is used in this region. It serves in brickyards, and even in iron and steel works; one establishment at Augustfehn requiring five to seven tons daily. The moors still in growth are impassable, but the older are of firmer surface. Of the latter, 270 □ km. are under cultivation, and a small part of the remainder is sometimes burnt over for growing buckwheat, filling the air with a dark, penetrating smoke. The moors are underlaid by sand or sometimes clay; and not unfrequently the remains of old forests of fir, birch, alder, hazelnut, and, on the higher ground, of oak, are found beneath the peat. Birch stumps are sometimes found growing on a thin layer of turf, showing an alternation of forest and moor conditions before the latter took final possession of the surface. Roman coins and weapons and the remains of plank roads are found four or more metres below the surface, implying a growth of that amount in two thousand years. Similar moorlands are common throughout northern Germany. — (*Peterm. mitth.*, 1883, 5.) W. M. D. [551

(*Asia.*)

North-eastern Borneo and Sulu islands. — W. B. Pryer, British north Borneo company's resident at Elopura, furnishes a general description of this region and its tribes. One of the chief features of north-eastern Borneo, or Sabah, is a low plain, some four thousand square miles in extent, enclosed by hills and mountains of sandstone and limestone on the north, west, and south. It has a heavy rainfall, and receives also the drainage of the high lands to the west in the form of numerous large rivers, along which there are many native villages in spite of the danger from fever. The higher land is thought probably suitable for European settlement. The forest fauna includes the elephant, rhinoceros, orang-outang, and some twenty kinds of monkeys, besides buffalo, deer, pigs, and bear, and many other animals. The largest orang-outang found measured four feet four inches in height; their appearance is deceptive, as they seem much taller. The adjoining islands of the Sulu archipelago are generally volcanic, though no volcanic rock is found on the part of Borneo visited. The islands are hilly, populous, generally cleared, and fairly well cultivated. They are surrounded by white coral strands, and, with their moderate temperature and pleasant, light breeze, are unusually attractive. The tribes of this region are very numerous. Some interesting details of their customs and condition are given. — (*Proc. roy. geogr. soc.*, 1883, 90.) W. M. D. [552

(*Pacific Ocean.*)

Mindanao. — The account of Dr. J. Montano's ethnographic exploration of this island of the Philippine group includes a few notes on its physical appearance. Its rocks are generally eruptive, partly covered with deposits of coral rock, implying a modern upheaval. Similar coral reefs fringe the shore. Near the northern end of the island is the circular Lake Mainit, about five miles in diameter, apparently situated in an ancient crater with steeply sloping borders. Earthquakes are frequent and violent in its vicinity. The surrounding mountains contain warm springs, and, especially when the atmospheric press-

ure is low, are covered with vapors from these warm waters. Rain is heavy on the eastern coast (winter months), and the rivers are frequently in flood. — (*Bull. soc. géogr. Paris*, 1882, 593; map.) W. M. D. [553

BOTANY.

(*General and physiological.*)

Effect of electric light on vegetation. — From experiments conducted at the Palais d'industrie during the electric exhibition of August, 1881, P. P. Déhérain concludes that the electric arc emits some rays injurious to vegetation, which are, for the most part at least, arrested by colorless glass. The light is sufficient to maintain mature plants in vegetation for two months and a half, and is decidedly beneficial to plants which obtain only diffuse daylight, but cannot effect the ripening or germination of seeds. — (*Electrician*, Feb. 10.) J. T. [554

Nettles as artillery-plants. — L. H. Bailey, jun., finds, that, under favorable circumstances, Urtica gracilis exhibits an elastic erection of stamens, coupled with dehiscence of their anthers, which scatters the liberated pollen in puffs. The same phenomenon is recorded for this and other genera of Urticaceaè by a number of writers. — (*Bot. gazette*, Feb.) W. T. [555

Fertilization of Catalpa speciosa. — According to the observation of one of Prof. Beal's students, only large bumblebees brush anthers and stigma, and so pollinate the flowers while gathering their nectar. The stigma is sensitive, its lobes closing after being touched. The mode of fertilization of this species is similar to that of the common southern species with which it was long confounded. — (*Bot. gazette*, Feb.) W. T. [556

The formation of starch out of sugar. — It is not yet known with certainty what is the first product of assimilative activity in a vegetable cell containing chlorophyll. Among the views most widely held may be cited those of Sachs and of Boehm. The former regards it as highly probable that the first and direct product is starch, while the latter holds that it is one or more of the sugars. As is well known, starch-grains are found in chlorophyll-granules after exposure to light. But Boehm thinks that the presence of starch in the granules of chlorophyll is no proof that this is the first product of assimilation, since it might have been formed there by the changes in other and simpler carbohydrates. That such changes may take place is rendered more than possible by his discovery that starch can be made in chlorophyll-granules out of sugar *artificially* furnished the plant. Nor does it, according to him, make much, if any, difference which of the sugars is used for the experiment. His method of experiment appears to be open to criticism, but is simple and ingenious. In the main, it consists in supplying to cut surfaces of herbaceous parts a dilute solution of sugar, being careful to avoid too great concentration of the liquid. The result of this administration of elaborated food is immediate. Starch-grains appear at once in the chlorophyll-granules, and the leafy shoots keep fresh and active for six weeks. — (*Bot. zeit.*, Jan. 19 and 26, 1883.) G. L. G. [557

(*Systematic.*)

A new Oxytheca. — An Oxytheca from the Mohave region, California, described by Dr. Parry, is the eighth of that genus, which is now quite polymorphous in its character. This species is especially distinguished by the spreading, several-flowered involucre, which is cleft nearly to the base, the segments closely resembling the bracts. — (*Bull. Torr. bot. club*, Feb., 1883.) S. W. [558

New species of Agrostis. — Two small sub-alpine species of Agrostis are described by Dr. Vasey, — one from the San Bernardino Mountains, California; the other, from Mount Adams, in Washington Territory. The author does not recognize Mount Adams and Mount Paddo as only different names for the same peak. — (*Bull. Torr. bot. club*, Feb., 1883.) S. W. [559

New Passifloreae. — Dr. Masters proposes a new genus (Mitostemma), remarkable for its peculiar corona, consisting of numerous thick thread-like processes arranged in a triple series at the throat of the very short flower-tube, and having the hypogynous stamens separate from the gynophore. Two species are described, from Brazil and British Guiana; also a new species of Tacsonia, and five of Passiflora, one of the latter from Mexico, the rest from tropical South America. — (*Journ. bot.*, Feb., 1883.) S. W. [560

Selaginella tortipila. — Mr. Baker, in the synopsis of the genus Selaginella, which he has commenced, reduces this supposed species of the higher Alleghanies to a form of the very widely distributed S. rupestris. — (*Journ. bot.*, Feb., 1883.) S. W. [561

(*Fossil plants.*)

Permian Ginkgos and other fossil plants. — Saporta describes a Salisburia, or Ginkgo, from specimens communicated by M. Grand'Eury from the Permian of Russia. The author considers the plant as a representative of the most ancient species of Ginkgo, and calls it Salisburia primigenia; remarking, that, until now, the Ginkgo has not been known lower than the Rhetic. This is contradicted by the discovery made by Profs. Fontaine and White, in the Permo-carboniferous of Virginia, of fine large leaves, very similar to those of Salisburia, described and figured under the name of Saportea Salisburioides and S. grandifolia (*Second geol. survey Penn.*, PP, pl. 38). If M. Saporta has not seen the specimen, he has at least seen these figures of the leaves, and admitted their close affinity to Salisburia, — an affinity supported by the presence of leaves of Baiera in the same strata. The memoir describes also a new species of Nelumbium, from the lignites of Fuveau, Bouches du Rhône, and mentions a number of plants discovered under the volcanic ashes of Kantal, lower pliocene. Some of the specimens represent tertiary types, like Abies intermedia, a new species; Corylus insignis, Heer; Planera Ungeri, Ett.; Acer pseudo-campestre, Ung.; Tilia expansa, Sap.; and Pterocarya denticulata, Web. Of species living at the present epoch, he quotes Salix mauritanica, Def.; Viburnum pseudo-tinus, Sap., nearly identical to Viburnum rugosum, Per.; a Ruscus, like R. aculeatus; a Ranunculus, like R. philonotis; and Fagus sylvatica-pliocenica, whose organs of fructification have been found. The leaves show a gradual passage to the European species, while they are evidently related to the American Fagus ferruginea, Michx. — (*Comptes rendus*, April 3, 10, 1882.) L. L. [562

ZOÖLOGY.

Mollusks.

Report on the mollusks of the north Atlantic. — The Norwegian north Atlantic expedition, under the direction of Prof. H. Mohn, during 1876-78, made, as is well known, valuable researches into the biology, as well as the hydrography, of the deep sea between Norway, Spitzbergen, and Jan Mayen. Sev

eral of their reports have appeared. The last is that of H. Friele on the mollusks, including those belonging to the Buccinidae. It is printed in parallel columns of Norwegian and English, and illustrated by six quarto plates and a map. The paper is practically a monograph of the Buccinidae of the arctic part of the north Atlantic and its shores. The new genus Jumala is described for Fusus Turtoni Bean and Neptunea Ossiani Friele. It is founded on important differences in the dentition. Several species, which had been before but briefly described, are here figured and characterized in detail. Siphonorbis Dalli, S. undulata, Buccinum nivale, B. sulcatum, new species, and a large number of new varieties, are described, — not merely the shell, but, in a majority of cases, the embryo, oötheca, operculum, and dentition, with various anatomical and biographical details. Friele finds, like others who have studied large series, that species, in the old-fashioned sense, can hardly be said to exist in the genus Buccinum; and, indeed, Neptunea is not much better; but the author considers that a certain part of this confusion is caused by hybridization. — W. H. D. [563

Worms.

North-sea annelids. — G. A. Hansen, in Norwegian and English (in parallel columns), gives an account of the annelids collected by the Norwegian North-sea expedition of 1876–78 (Christiania, 1882, 53 p., 7 pl., map, 4°). He criticises Malmgren's method of distinguishing and delimiting genera, of which he thinks Malmgren has made far too many on unimportant characters. He points out the constancy of the bristles: "The type of the bristles is the same in all Polynoae, with the exception of Melaenis Loveni and Polynoe scolopendrina." The scales, in Hansen's opinion, are much more valuable, being characteristically constant in each species. Möbius and Tauber have gone too far in the opposite direction, of 'lumping' Malmgren's species and genera. Tables of distribution are given, from which it is evident that few families are absent from the frigid area, and the species are the same as those found in temperate waters. P. globifera alone indicates that its favorite, if not its sole, habitat is the cold bottom-strata. A number of new species are described. — (*Journ. micr. soc. Lond.*, Feb., 1883, 60.) C. S. M. [564

Australian Aphroditea. — W. A. Haswell publishes a monograph of the Australian species of this annelidan family, wherein he gives descriptions of about thirty species, of which more than half are new. There appear to be two entirely distinct provinces of distribution, — the northern intertropical shores of Queensland, and the temperate coasts of New South Wales and Victoria. As compared with the same group in northern seas, there is no marked distinction of the forms: the species are different, but the genera the same or nearly related. The first part of the paper is anatomical, and contains interesting notes on the structure of the scales. He corrects Williams's mistake of describing the intestinal coeca as segmental organs, — a mistake repeated by Ehlers, — and himself describes the true segmental organs in Polynoe. They are ciliated tubes, opening in a tubercle at the base of the parapodia. Some observations on the sexual organs, the coeca of the intestine, and the pseudhaemal system, are also recorded. The form of the coeca is described. "The interior of the coecum is lined here and there with 'hepatic cells.' These are large spherical or oval cells, with a delicate . . . membrane, and golden-yellow, oil-like contents, with a nucleus, or, more frequently, two or three." Among these yellow cells are others of the same size, but of very different character, containing numerous cells, each enclosing a spherical green body. Haswell thinks these are the young stages of the yellow cells. — (*Proc. Linn. soc. New South Wales*, vii. 250.) C. S. M. [565

Anatomy of Ctenodrilus. — Kennel's valuable monograph of the anatomy of Ctenodrilus is to be supplemented by a memoir on another species of the same genus (C. monostylos) by Zeppelin, who has published a preliminary notice of his results. An abstract will be given here of the final memoir when published. (*Zool. anz.*, vi. 44.) C. S. M. [566

VERTEBRATES.

Third corpuscle of the blood. — Dr. Richard Norris of Birmingham, Eng., claims to have discovered that the white corpuscles of the lymph peel off the body of the cell, setting the nucleus free. The latter then enters the circulation as a colorless disk, which is ordinarily invisible, having the same refractile index as the *liquor sanguinis*. The disk gradually becomes colored by the endogenous secretion of haemaglobin. He then applies this history to set aside a good many established views concerning the physiology and pathology of the blood. He has presented his opinions in an octavo volume illustrated with numerous plates, forming a revolutionary publication (London, 1882). We should *a priori* give little credence to these surprising conclusions, which have been subjected to telling criticisms by Mrs. Ernest Hart. Norris's principal observation was, that, by certain methods of treatment, colorless disks could be found in the blood, and photographed. Mrs. Hart has repeated his numerous and varied experiments, and shows that the methods employed create the colorless disk out of the red corpuscle by removing, in one manner or another, the haemaglobin. The basis of Norris's theories is thus taken away, and with the base fall all the far-reaching deductions built on it. Nevertheless, although Dr. Norris's interpretations cannot be accepted, it should be remembered that he has published a series of careful and useful observations. — (*Lond. med. rec.*, Oct. 15, 1882.) C. S. M. [567

Nerves of the bile-ducts. — Variot has confirmed and extended Gerlach's observations (*Centralbl. med. wiss.*, xxxvi). The author first gives a brief account of the structure of the bile-ducts and gall-bladder. The nerve-fibres on the ducts are rarely medullated. In gold-chloride preparations one sees the large meshes of the submucous nervous plexus of naked fibres. The ganglion-cells lie mostly in the nodes of the plexus, but are also found elsewhere between the fibres; now and then they are clustered into a little ganglion. A second intermuscular plexus, such as Gerlach described, could not be observed. Nothing was learned of the ultimate terminations. The distribution of the ganglia was studied in longitudinal sections through Vater's ampulla and the neighboring part of the ductus choledocus. At the point of junction is found an extension of Auerbach's plexus. Between the two muscular layers lie the ganglia; but nothing corresponding to Meissner's plexus was found; although, at the junction of the intestinal and ductal mucosa, there is a mass of ganglia. The observations were made on man, dogs, and cobayas. — (*Journ. de l'anat. physiol.*, xviii. 600.) C. S. M. [568

Salivary alkaloids. — Gautier found in normal human saliva an alkaloid-like non-nitrogenous substance, forming a crystallizable compound with chloride of gold and platinum. In its physiological actions this alkaloid resembled the post-mortem alkaloids (*ptomaïnes*): injected into animals, it acted like snake-

poison, especially on birds. The directions given for preparing the alkaloid, and information as to the quantity of it necessary to produce lethal results, have, however, been very deficient. Budwin, desiring to obtain further information on the latter point, arrives at results which throw doubt on the whole matter. He finds that fresh extract of 100 cub. cm. of human saliva subcutaneously injected does no harm to frogs, moles, or pigeons. — (*Arch. path. anat. phys.*, xci., 1883, 190.) H. N. M. [569

The influence of heat and cold upon muscles poisoned by veratria. — It has for some time been known, chiefly from the work of V. Bezold, that veratria exercises a remarkable influence upon muscular contractions. A rapid and powerful contraction is followed by an extraordinarily slow relaxation. In the hope that closer study of the veratria muscle-curve might throw some light upon the nature of a muscular contraction, Lauder Brunton and Cash have made a fresh study of it, especially investigating it under different temperatures. Their work, while not giving much information in regard to this primary point, has led to some interesting results. They find that the influence of veratria varies much with the temperature of the muscle experimented upon. Up to a certain limit, heat increases the effect of the drug; cold diminishes it. Exposure to extremes of heat or cold not sufficient to kill the muscle prevents entirely the manifestation of the usual veratria symptoms. The authors point out, that the modifications which temperature-changes bring about in the action of veratria on muscle suggest that temperature may modify the influence of other drugs, not only on muscles, but on nerves and nerve-centres. Accordingly the different action of drugs on different animals, or on the same animal in various physiological and pathological conditions, may be due in part to temperature differences, physiological or pathological, of the organisms to which they are administered. — (*Journ. of physiol.*, iv. 1.) H. N. M. [570

Conditions influencing the amylolytic action of saliva. — Working with saliva previously carefully neutralized, — a precaution which has not been always taken by previous observers, but which is clearly necessary on account of the variable acidity or alkalinity of different specimens of saliva, — Langley and Eves arrive at the following conclusions: 1°. Neutralized saliva converts starch into sugar much more actively than unneutralized. 2°. .0015 per cent H Cl distinctly diminishes the amylolytic action of ptyalin. 3°. Sodium carbonate also diminishes the activity of previously neutralized saliva, and more the more of the alkaline salt is present. 4°. .005 per cent H Cl has a very obvious destructive influence on ptyalin. 5°. Sodium carbonate has a very slight destructive power, but greatly retards the action of the salivary ferment. 6°. Neutralized saliva converts starch into sugar more quickly in the presence of neutral peptone than in the presence of peptone plus dilute H Cl. 7°. The larger the percentage of acid in proportion to the peptone, — that is to say, the more acid unemployed in combining with the peptone, — the more marked the injurious influence of the acid. Even before the peptone is completely saturated with acid, the injurious effect, due apparently to the presence of acid-peptone, becomes obvious. 8°. Ptyalin is destroyed by acid combined with peptone much more slowly than by the same amount of acid without the peptone. 9°. When peptone is present, the deleterious influence of sodium carbonate is greatly diminished. Not merely peptone, however, but myosin, alkali albumen, and acid albumen act in the same protective manner. The authors conclude that all ptyalin is destroyed in the stomach very soon after that first brief stage of gastric digestion in which no free acid is present. — (*Journ. of physiol.*, iv. 18.) H. N. M. [571

Mammals.

Caudal end of vertebrate embryos. — In his studies on the development of Melopsittacus, Braun observed that a constriction is formed around the end of the tail, which leads to the construction of a terminal knob, connected by a thin stalk with the base of the tail. Into this *nodulus caudalis* the chorda and medullary tube originally extend; but they afterward withdraw from it, leaving the nodulus, a ball of mesoderm covered by ephithelium, to be finally resorbed. This discovery led Braun to search for similar structures in mammals, and he now publishes his results. His investigations were made principally on sheep embryos, and observations were also made on those of other species. He finds an homologous structure, having, however, more usually a thread-like form. In sheep it may be readily seen in most cases when the tail is from 1. 5 to 3 mm. long. His general results are: 1°. The tail of mammalian embryos consists of two parts, — an anterior or basal vertebrate; and a posterior invertebrate and smaller portion, which, from its usual form, may be called the caudal thread. 2°. The vertebrate portion may be partly or wholly embedded in the body (internal tail), and terminates at the sacral vertebrae in front; the division of the tail which protrudes is the external tail. 3°. The caudal thread contains originally the terminal portions of the chorda dorsalis, the medullary tube, and the caudal gut (*schwanzdarm*). These are the first parts of the thread to be resorbed; the rest disappears later, the epidermal covering lasting longest. 4°. The caudal gut is a rectal coecum; before it is resorbed, it breaks up into single parts, of which those in the tip of the tail endure the longest. 5°. The chorda dorsalis projects beyond the last vertebra, its ending being often forked or contorted. 6°. The medullary tube reaches to the tip of the tail or the base of the caudal thread, and its posterior end is probably resorbed. Braun further believes that he has found traces of a neurenteric canal in sheep embryos. He adds a discussion of the tail in human embryos. Finally he homologizes with the embryonic caudal thread, the soft coccygeal appendix of Innus pithecus, and similar structures found abnormally in the chimpanzee, orang-outang, and man, and gives citations to prove that the caudal thread exists in human embryos. — (*Arch. anat. physiol., anat. abth.*, 1882, 207.) C. S. M. [572

Mucous layer of the skin. — Ranvier has made sections of the human skin, hardened in bichromate of ammonia (2%) for two or three months, and then with gum and alcohol. In these the intracellular network is well shown by haematoxylin. The fibres of the network project beyond the cell, and establish the union between the cells. In the intercellular spaces these fibres are thicker than within the cells: they have therefore acquired an additional envelope. Ranvier further argues against considering the threads as protoplasm, but maintains that the clear substance in which they are embedded is the true protoplasm in all cells derived from the ectoderm. This is especially maintained for the central nervous system. (His arguments do not appear convincing). — (*Comptes. rend.*, xcv. 1374.) C. S. M. [573

ANTHROPOLOGY.

The archeology of Russia. — Count Ouwarof of Moscow published, in 1881, a work on the prehistoric archeology of Russia. As to paleolithic man,

the author sums up the result of his researches in a few sentences. 1. His existence is completely demonstrated. 2. He had spread himself to the north as far as 33° 35′. 3. The Chelléenne epoch of Mortillet has not yet been met with in Russia. 4. The Mousterian epoch, on the contrary, is well represented, as well in Poland (Zawisza) as in the Crimea (Mérejkowsky). 5. The epoch of Solutré has not been observed. 6. The epoch of La Madeleine has been well identified in Poland and in the Crimea. Regarding the neolithic age, the author believes that in Russia there is no such hiatus separating it from the paleolithic as seems to have existed in France and Belgium. Count Ouwarof has enjoyed and utilized rare opportunities for extensive researches over the vast Asiatic and European territory under the domination of the Czar. — J. W. P. [574

The human fauna of the District of Columbia. — With reference to the former aborigines, Prof. Otis T. Mason stated that the remains were of three kinds, — so-called drift implements on the surface, chipped implements on the surface, and soapstone quarries. While former censuses had stated the population of the district, the health and police records had not been published in such form as to give good results. The death-rate is as follows for seven years: —

	Population.			Deaths.			Death-Rates.		
Year.	Whites.	Colored.	Total.	Whites.	Colored.	Total.	Whites.	Colored.	Total.
1876	106,741	50,859	157,600	2,090	2,072	4,162	19.58	40.74	26.35
1877	109,505	52,870	162,375	2,190	2,014	4,204	20.00	37.39	25.89
1878	112,340	54,960	167,300	2,167	2,068	4,235	19.29	37.63	25.32
1879	115,247	57,053	172,300	2,196	2,113	4,309	19.06	37.03	25.00
1880	118,236	59,402	177,638	2,085	2,121	4,207	17.63	35.71	23.68
1881	121,300	61,760	183,060	2,205	1,931	4,136	18.18	31.27	22.59
1882	124,441	64,212	188,643	2,353	2,218	4,571	18.91	34.54	24.23

In this table should be noticed the preponderance of colored deaths, the diminishing death-rate, and especially the better health of the excessive colored population.

The crime of the district was also discussed, and some very interesting facts elicited. In the census year the arrests were as follows: —

		1879.		1880.	
	Population.	Arrests.	Per cent.	Arrests.	Per cent.
Males . . .	83,578	10,839	.1297	11,432	.1367
Females . .	94,046	1,771	.0188	2,126	.0226
Total . .	177,624	12,610	.0709	13,558	.0763

All births in the district are not recorded, so that it is impossible to draw safe conclusions regarding the natural increase of population. The sources of information, in collating the material for this paper, were the census-office, the board of health, and the superintendent of police. — (*Biol. soc. Wash.; meeting* March 2.) [575

Bandelier's investigations in New Mexico. — The language, manners, and arts of the modern Indians were examined with minute care. The ruins which antedate the sixteenth century, according to architectural characters, are divided as follows: 1. Cave-dwellings; 2. Cliff-houses; 3. One-story buildings of stone, forming scattered villages; 4. Large houses with retreating stories. "There appear to be, in fact, but two types of aboriginal architecture in New Mexico, — the many-storied communal house and the one-story building of stone. The latter is either found in villages on the level ground and on gradual slopes, or clustering on rock-shelves, and scattered in recesses like the so-called cliff-houses. The cave-dwellings appear as an incidental form, resulting from the ease with which the rock was hollowed out, or from the existence of natural cavities, which, from their size and the security of their position, afforded advantages superior to those of independent buildings." — (*Bull. arch. inst. Amer.*, No. 1.) J. W. P. [576

Mohammedans in the world. — A writer in the Missionary herald makes the following calculation of the Mohammedans in the world: Turkish empire, 20,000,000; Persia and the Caucasus, 12,000,000; India, 41,000,000; East Indies, 23,000,000; China, 5,000,000; Egypt, 8,000,000; Morocco, 2,750,000; Algiers, 2,920,000; Tunis, 2,000,000; Tripoli, 750,000; Sahara, 4,000,000; Soudan, 38,000,000; Zanzibar, 380,000; Central Asia, 14,000,000; total, 173,800,000. — (*Miss. herald*, March, 1883.) J. W. P. [577

The manuscript Troano. — After the brilliant feats in paleography of Grotefend and Champollion, — the former in deciphering the cuneiform; the latter, the hieroglyphics of Egypt, — nothing seems too hard for the student of philology. Of all the outstanding languages, the Maya of Yucatan presents the greatest temptation to the decipherer. In the forthcoming fifth volume of Contributions to North-American ethnology, published by Major J. W. Powell, Dr. Cyrus Thomas presents a monograph upon the Manuscript Troano, already published separately, and occupying 237 quarto pages, illustrated by 31 plates and 101 figures. This volume is the result of years of study, and the last word in an elaborated form of many preliminary utterances and publications. In typography, illustrations, and indexes, it realizes our ideal of a book, yielding the maximum of information and pleasure for the minimum of effort on the part of the reader. In an Introduction, by Dr. Brinton of Philadelphia, are clearly set forth the phonetic system of Central-Americans, the description thereof by Spanish writers, references to Maya literature in the native language, the existing codices, and the previous efforts at interpretation that have been made. Dr. Thomas clearly defines his method in his preface: "I have studied the manuscript somewhat in the same way the child undertakes to solve an illustrated rebus, assuming as a stand-point the status of the semi-civilized Indian, and endeavoring, as far as possible, to proceed upon the same plane of thought." The results attained are as follows: 1. The work was a ritual or religious calendar. 2. The figures in the spaces are symbols, or pictographs, relating to religion, habits, occupations, and customs. 3. It was prepared for people living away from the sea. 4. They were sedentary, agricultural, and not warlike. 5. The evidences of human sacrifice are very meagre. 6. The cross was a religious emblem. 7. Although the figures move from right to left in pairs, the characters are in columns, to be read from the top downwards, columns following each other from left to right. 8. There is no rule for the arrangement of parts in compound characters. 9. The characters are not true alphabetic signs, but syllabic; some are ideographic; others abbreviated pictographs. 10. The work was written

about the middle or latter half of the fourteenth century. 11. The Ahau, or Katun, was a period of twenty-four years; and the great cycle, of three hundred and twelve years; also the series commenced with a Cauac instead of a Kau year. 12. Brasseur was right in supposing that the work originated in Peten. In a future issue we hope to present a review of this work. — J. W. P. [578

Craniometry for general use. — Confusion of the worst kind exists among the craniologists in the following particulars, — the base line or orienting of the skull, what marks or characters have anthropologic significance, and the comparative value of the various parts. We have even a French school and a German school. Both of these have been simplifying their methods of late. The Germans held a craniometric conference at Munich in 1877 (*Corr.-blatt.*, 1878, No. 7), one in Berlin in 1880 (*Corr.-blatt.*, 1880, 104-106), and finally came to an agreement at Frankfort in 1882. The result of the last meeting now appears (*Corr.-blatt*, No. 1, 1883), signed by the most distinguished craniologists in Germany. A model-chart in blank accompanies the report, with spaces for number, source, sex, age, skull, countenance, and indices. The number of measurements required are very reasonable, and they are not difficult to make. — (*Corr.-blatt. deutsch. ges. anthrop.*, xiv., No. 1.) J. W. P. [579

EGYPTOLOGY.

Art in Egypt. — In a discriminating review of Perrot's great work, Miss A. B. Edwards says, M. Perrot "has so thoroughly entered into the spirit of ancient Egyptian culture, so firmly grasped the central idea of ancient Egyptian belief, that he has been enabled, not only to trace those influences through every ramification of Egyptian art, but, from a purely philosophic stand-point, to survey and treat his subject as a co-ordinate whole. This it is which gives pre-eminent value to the present work. This it is which we here find attempted and achieved for the first time. And, in truth, it is only within the last few years that such a work has become possible." — (*Academy*, Feb. 17.) H. O. [580

Pithom-Succoth. — The Egyptian exploration fund of England has signalized its advent to Egyptian soil by a discovery promising great results. M. Naville, on the suggestion of Maspero, director of the Boolak museum, began exploration at Tel-el-Maschuta, — a heap of ruins beside the Sweet-water Canal, south of the railway, east of and near Mahsamah, and about fifteen miles west of Ismailia. He writes, Feb. 12, 1883, "I have a piece of good news to begin with. Tell-el-Maschuta *is* Pithom, or, in other words, the temple of Tum, in the city or region of Thuku, which Dr. Brugsch has identified with Succoth. . . . I can give it for certain from the inscription of a statue belonging to a priest of the temple." M. Naville also found a Roman milestone with the inscription, —

DD NN VICTORIBVS
MAXIMIANO ET SEVERO
IMPERATORIBVS ET
MAXIMINO ET CONSTANTI . .
NOBILISSIMIS CAESARIBV.
AB ERO IN CLVSMA
MI VIIII P.

'Ero' would be the transcription of Ar (Ari or Aru), which means the storehouse, and which is found on the statue of the priest. His titles are "the chief of the storehouse of the temple of Tem [Tum] of Theku [Thuku]." Reginald Stuart Poole and Miss A. B. Edwards regard this as a momentous discovery. — (*Academy*, Feb. 24, March 3.) H. O. [581

Love-songs. — How the ancient Egyptian young men and maidens confessed their love, and rejoiced or mourned, may be learned from Maspero's translation of the hieratic papyrus of Turin, published in facsimile by Pleyte and de Rossi, pl 79–82. This had been translated by Fr. Chabas (*Rec. of past*, vi. 156); but a rearrangement of the broken parts of the papyrus has enabled Maspero to gain a clearer view of the whole. Maspero sees a clear resemblance between the Hebrew and the Egyptian conception of love, and suggests that a comparison of the Hebrew with the Egyptian language of love would explain some points now obscure. — (*Journ. asiatique*, Jan.) H. O. [582

Geographical lists of Karnak. — The only text of these lists open to students is the very faulty one in Les listes géogr. des pylones de Karnak, etc., edited by Mariette in 1875. In an open letter to Brugsch, which is accompanied by two pages of facsimiles, Golenischeff offers many corrections of these lists. He says, "While these lists are of the greatest importance, the study of them in the faulty copies in Mariette's Karnak is not to be recommended." — (*Zeitsch. ägyp. sprache*, 3 heft, 1882.) H. O. [583

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Bureau of ethnology.

Explorations in the Mississippi valley. — Mr. P. W. Norris, on behalf of the bureau, devoted last summer to the examination of mounds and other antiquities of the valley of the Mississippi. His explorations were confined chiefly to eastern Iowa and south-western Missouri, though trips were made to Wisconsin, Minnesota, and Mississippi. Among the results of the work, we mention the following: —

Several somewhat extensive groups of effigy-mounds were discovered in north-western Iowa. One of the groups bears a strong resemblance to one referred to in William Pigeon's singular volume.

In the same region ancient earth-works were found in which the enclosing wall is of the form given in De Bry's figures of the Palisades.

From a mound opened in Wisconsin, a copper kettle, silver bracelet, silver rings, and a silver locket were taken, indicating its modern origin. Two new localities of Indian pictographs were found, and the drawings copied.

Besides stone implements, pottery, pipes, and other evidences of aboriginal art usually found in mounds, two very nicely carved statuettes were obtained in Mississippi. Mr. Norris's collection consists of nearly a thousand specimens.

Professor Cyrus W. Thomas is in immediate charge of these mound-explorations; and the work of the past season is represented by a collection of nearly three thousand five hundred specimens.

Department of agriculture.

Results of field experiments with various fertilizers. — Professor Atwater has given the results of a large

number of experiments of a special and general nature, carried on at his suggestion in different parts of the country for the purpose of studying the demands of our chief crops for various fertilizing materials. In a general discussion of the results, he concludes that corn responds but little to nitrogen, being able to gather its small supply from natural sources, and, for this reason, is not to be regarded as an exhausting, but more nearly a renovating crop. It responds, however, liberally to supplies of mineral fertilizers, phosphoric acid or potash being the dominant under different circumstances, depending upon soil and season. Potatoes have been found to respond uniformly to all the fertilizing ingredients; and they have less capacity than corn for gathering from natural sources. The same is apparently true for turnips. For other crops the number of experiments does not justify conclusions. Practically the largest average yield for all crops was obtained with the complete fertilizers. Nitrate of soda, and superphosphate, yield less than potash and superphosphate, which is significant of the value of potash, and the propriety of adding more of it to our fertilizers. Nitrate of soda, and potash, proved the least efficient. Separately, the nitrate of soda was rarely useful, the sulphate of lime frequently, the muriate of potash very often, and the superphosphates generally. Soils vary widely in their capacity for supplying food to crops, and consequently in their demands for fertilizers; and there are many conditions affecting their action after application. The only way to find what a particular soil wants is by careful observation and experiments.

Lawes and Gilbert's paper on the sources of nitrogen in crops, read at the meeting of the American association at Montreal, is appended to Professor Atwater's report. After maintaining that there is much more experimental proof of the fact that the soil is the source of nitrogen for all crops than that any can be assimilated from the air, a comparison is made between the comparatively recently broken-up soils of America and those of England, which have been long under arable cultivation. Analyses of four soils from the west show a much greater percentage of nitrogen than was found in those at Rothamsted; or, in general terms, the surface-soils of our territories are more than twice as rich in nitrogen as the average Rothamsted soil. In the face of this fact, the difficulty arises as to why less wheat can be raised upon the rich soils of the north-west than upon the worn-out soils of England. As far as they are informed, these writers attribute this result to vicissitudes of climate, and lack of care in cultivation.

This conclusion can hardly be considered as satisfactory; and it remains a question worthy of the greatest attention, as also whether these now rich soils are not being impoverished by the present method of cultivation.

NOTES AND NEWS.

— The gold medal of the Royal astronomical society has this year been awarded to Dr. Benjamin Apthorp Gould, for his 'Uranometria Argentina.' In his address before the society, Feb. 9, on the presentation of the medal, the president, Mr. E. J. Stone, lately her Majesty's astronomer at the Cape of Good Hope, and now the director of the Radcliffe observatory at Oxford, made allusion to the number and variety of Dr. Gould's astronomical papers, which treat of almost all branches of the science, and especially to his reduction of D'Agelet's observations, — a work of considerable extent and of great value. All these were not without their influence in guiding the decision of the council in the award of the medal; but their attention was chiefly concentrated on Dr. Gould's direction of the work of the observatory at Cordoba, in the Argentine Republic. The principal part of this work may be considered an extension of Argelander's scale of magnitudes to all the stars which can be seen by a good eye, without instrumental aid, between ten degrees north declination and the south pole, together with a series of charts exhibiting on a stereographic projection the positions of all these stars to the sixth magnitude, and a proposed revision of the boundaries of the southern constellations. This was the work first undertaken by Dr. Gould on his arrival at Cordoba, with four assistants, thirteen years ago. Some indication of the magnitude of the work may be obtained from the fact that the number of estimations made for the formation of the 'Uranometria Argentina' exceeded forty-six thousand. Dr. Gould has carefully discussed the results of these estimations of stellar magnitude, and compared them with nearly all the materials which were available for the purpose; and, in particular, he has compared his estimations of the magnitude of the brighter stars with results obtained from a discussion of the photometric observations of the second Herschel and of Seidel.

The maps published by Dr. Gould are fourteen in number, one of which is a skeleton-map showing the proposed revision of the boundaries of the southern constellations. The materials collected in this uranometry are far more complete and accurate than any which previously existed; and Dr. Gould has therefore been naturally led to discuss their bearing on those great questions of the constitution of our stellar universe which offer so fascinating and inexhaustible a field for philosophical speculation. The results which he has obtained are in general accordance with those of previous investigators of the subject. It appears to be clearly proved that distance is one of the most important factors in producing differences of apparent brightness in the stars; but the agreement between the number of stars of different magnitudes, and the number which might be expected if these changes of apparent brightness depended solely on distance, is not perfect over any large range of magnitudes. There appears to be a decided preponderance in the number of the brighter stars. It is possible that this preponderance may be partially due to the conventional scale of magnitudes not being a truly photometric scale. Dr. Gould has been led, after a careful discussion of his own observations, to infer that the preponderance of the brighter stars is due to the existence of a stellar cluster consisting of some four or five hundred stars, of which our own system is supposed to be a member.

The position of the northern pole of the medial plane of this belt of stars has been fixed by Dr. Gould at R. A. 11 *h.* 25 *m.*, N. P. D. 60°, whilst that of the galactic circle is at R. A. 12 *h.* 41 *m.*, N. P. D. 62° 39′.

— The notes on the progress of astronomy during the past year, brought before the Royal astronomical society at its anniversary meeting, Feb. 9, related to the following subjects: small displacements of the plumb-line; investigations relating to the tides; the micrometric measures of the Harvard-college observatory; double star observations; Oppolzer's 'Syzygientafeln;' the constant of precession; the mass of Jupiter; discovery of minor planets in 1882; M. Gogou on a lunar inequality of long period, due to the action of Mars; the celestial charts of Prof. C. H. F. Peters; Professor Holden's monograph of the nebula of Orion; the Harvard-college observatory catalogue of stars for 1875; Dr. Huggins's photographs of the corona; astronomical photography; Houzeau's 'Bibliographie d'astronomie;' the transit of Venus; the comets of 1882; and Professor Langley's researches on the solar radiation.

— Col. Prejevalsky has given up his projected expedition to eastern Turkestan, and will probably, instead, be sent as chief of a government expedition to determine the boundary between Siberia and Mongolia.

— J. Martin is exploring the mountainous country of Siberia south of Yakutsk. His last report, dated November, mentions excessive cold, with a minimum of − 56° F., in which his party has suffered greatly. In spite of the general snow, he has made some observations on the rocks of the country, but details are not yet given.

— The annual report for 1882 is the latest example of the excellent work done by the Geological survey of New Jersey under the lead of Professor George H. Cook. It contains a well-colored state map (scale six miles to an inch), besides small outline-maps showing the river-basins and the progress of triangulation and topographic work. Chapters are given on the triassic formation; on the iron industry, showing an estimated output of 900,000 tons in 1882, — an excess of 140,000 over 1881, and larger than ever before; on the plastic clays, showing that the generalizations made in the special clay report and map (1878), are verified by recent work; on shore-changes, chiefly by erosive wave-action, proved by comparison of old and new surveys, amounting to two and three hundred yards at several places south of Barnegat Inlet; proved also by the discovery, at very low water after storms on Long Beach, of roots and axe-cut stumps, as well as horse and cattle tracks preserved in the firm sod of old marshes (p. 82); on water-supply, giving important statistics of rainfall, drainage-areas, and analyses; and recommending the boring of artesian wells, which the structure of the Atlantic slope would favor along the seashore, where the surface-water is generally poor. The probable depths at which water-bearing strata would be found are given for several points on the coast. Other topics are also treated. The expenses of the survey have been kept strictly within the appropriation of $8,000 a year.

The chapter on the triassic rocks has special technical value. It is remarkably well illustrated by tinted lithographs by Bien, showing the general triassic landscape at Plainfield, the columnar structure of the trap at Little Falls on the Passaic, the Palisade trap at its intrusive junction with the sandstones at Weehawken (a three-foot horizontal interbedded branch-dike in the lower part of this plate is colored like the sandstone), and the intrusions of trap between the shales at Martin's dock on the Raritan. The latter are much better than any illustrations of the triassic traps yet published. The working hypothesis adopted to explain the peculiarities of this puzzling formation seems open to criticism. The original connection of the New-Jersey and Connecticut sandstone areas is very improbable. Their similarity results rather from similarity of original conditions than from continuity. We believe that further observation will show the parallel Wachung Mountains to be, not intrusions, like the Palisades, but overflows of trap poured out on the sandstones during their formation, and altogether inactive in producing any perceptible share of the well-known monoclinal tilting. The curved form of these trap-ridges, and probably of all the many others of overflow origin in Connecticut, is the result of the trap-sheets having been faintly folded, with their conformably enclosing sandstones, long after their formation, and most likely at the time of general tilting. It is difficult to understand how any eruptive force would 'necessarily' produce such forms. The discovery of a few faults in the sandstones since 1868, when none had been found, gives hope that the origin of the monoclinal structure may some day be better understood. Apart from these somewhat hypothetical matters, an extended description is given of the character and distribution of the triassic rocks, for the purpose of enlisting the aid of local observers, whose contributions are much needed to 'solve the questions still open.' New Jersey is fortunate in having already progressed so far, and in having the road for further work so well marked out.

— Mr. G. Brown Goode has been appointed by the President commissioner to the London fisheries exhibition. Mr. R. E. Earll, Mr. A. Howard Clark, Capt. J. W. Collins, Mr. W. V. Cox, Capt. H. C. Chester, and Mr. Reuben Wood accompany the commissioner. Representatives of the Signal-office, U.S.A., Light-house board, and Life-saving service, have also been detailed for special duty in connection with the exhibition.

— The Marquis Antonio de Gregorio announces from Palermo, Feb. 9, that, if four hundred subscrib-

ers can be obtained, he will publish a Journal of geology and paleontology, which he hopes will become an international magazine, since he will accept articles written not only in Italian, but also in English, French, and German. It is to appear on alternate months, and contain from fifty to a hundred quarto plates a year. The subscription price is fixed at thirty scudi (dollars).

— The fifth annual meeting of the Ottawa field-naturalists' club was held on Tuesday, March 20. The report of the council shows that the club continues successfully the work for which it was organized. Three excursions were held during the summer, and five *soirées* during the winter. The club received during the year many valuable donations and exchanges, and published Transactions (No. 3), consisting of sixty-six closely printed pages, and two good plates. The number of members is a hundred and eight. Sixteen new members have been elected during the year. Notwithstanding the cost of publishing transactions, and increased general expenses, the club has a satisfactory balance on hand. The following officers were elected for 1883–84: president, H. B. Small, M.D.; vice-presidents, R. B. Whyte and Prof. J. Macoun; secretary, W. H. Harrington; treasurer, W. P. Anderson.

— Dr. George M. Steinberg has written a book, soon to be published, on 'Photomicrographs, and how to make them,' which will be illustrated with seventeen heliotype plates.

— In Science, p. 192, column 1, lines 10, 11, the clause, "the coal next the mouth not partaking of the motion of that farther in the hill," belongs to the preceding, and not the succeeding sentence.

RECENT BOOKS AND PAMPHLETS.

Arnold, G. M. Robert Pocock, the Gravesend historian, naturalist, antiquarian, and printer. London, *Low*, 1883. 8°.

Bonnier, G., et **Leignette**, A. Premiers éléments des sciences usuelles. Leçons des choses: or, argent, monnaies. Paris, *Dupont*, 1883. 36 p., illustr. 12°.

Boston society of natural history. Constitution and by-laws, with a list of officers and members. [Boston], 1883. 35 p. 16°.

Braconnier, M. A. Description géologique et agronomique des terrains de Meurthe-et-Moselle. Nancy, *imp. Berger-Levrault et Cie*, 1883. 444 p., illustr. 8°.

Bradshaw, J. New Zealand as it is. London, *Low*, 1883. 8°.

Broglie, duc de. La science et la religion: leur conflit apparent et leur accord réel; leçon d'ouverture du cours d'apologétique chrétienne professé à l'Institut catholique de Paris. Paris, *imp. Levé*, 1883. 62 p. 18°.

Cadet, F. Lettres sur la pédagogie, résumé du cours de l'hôtel de ville (mairie du 3e arrondissement). Paris, *Chaix, imp.*, 1883. 310 p. 16°.

Caspari. Détermination de positions géographiques en Cochinchine. Paris, *imp. nationale*, 1883. 30 p. 8°.

Cassino, S. E. The international scientists' directory; containing the names, addresses, special departments of study, etc., of amateur and professional naturalists, chemists, physicists, astronomers, etc., in America, Europe, Asia, Africa, and Oceanica. Boston, *Cassino*, 1883. 8+150+299 p. 12°.

Catalogue de la collection archéologique provenant des fouilles et explorations de M. Désiré Charnay au Mexique et dans l'Amérique centrale pendant les années 1880, 1881, 1882, exposée provisoirement au palais du Trocadéro. Paris, *Tremblay*, 1883. 14 p. 8°.

Charles, E. Lectures de philosophie, ou Fragments extraits des philosophes anciens et modernes. 2 tom. Paris, *Belin et fils*, 1883. I., 8+556 p. II., 590 p. 12°.

Charpentier, A. Étude de l'influence de la coloration sur la visibilité des points lumineux. Paris, *imp. Davy*, 1883. 7 p. 8°.

—— Note complémentaire relative à l'influence de la surface sur la sensibilité lumineuse. Paris, *imp. Davy*, 1883. 7 p. 8°.

Church, A. H. Precious stones considered in their scientific and artistic relations; with a catalogue of the Townshend collection of gems in the South Kensington museum. With a colored plate and woodcuts. London, *Chapman*, 1883. 116 p. 8°.

Dauge. Leçons de méthodologie mathématique à l'usage des élèves de l'école normale des sciences, annexée à l'Université de Gand. Gand, *G. Jacqmain*, 1883. 416 p. 4°.

Delage, A. Éléments d'histoire naturelle des pierres et des terrains (programmes officiels du 2 août, 1880), pour la classe de quatrième. Paris, *imp. Martinet*, 1883. 173 p., illustr. 16°.

Eve, H. W., **Sidgwick**, A., and **Abbott**, E. A. Three lectures on subjects connected with the practice of education, delivered in the university of Cambridge in the Easter term, 1882. Cambridge, *Cambridge Warehouse*, 1883. (Pitt press series.) 92 p. 12°.

Fabre, G. Étude sur les eaux minérales de Caprem (Hautes-Pyrénées). Paris, *imp. Davy*, 1883. 56 p. 8°.

Greer, H. The storage of electricity. N.Y., *Coll. electr. eng.*, 1883. 40+14 p. 8°.

Hamard. L'Age de la pierre et l'homme primitif. Lyon, *imp. Waltener et Cie*, 1883. 13+503 p., illustr. 18°.

Hanstein. Le Protoplasma considéré comme base de la vie des animaux et des végétaux. Traduit de l'allemand. Paris, *Coulommiers*, 1883. 132 p. 18°.

Hoffman, F., and **Power**, F. B. A manual of chemical analysis as applied to the examination of medicinal chemicals. Philad., *Henry C. Lea's Son & Co.*, 1883. 628 p. 8°.

Hull, E. Contributions to the physical history of the British Isles. With a dissertation on the origin of Western Europe and of the Atlantic Ocean. London, *Stanford*, 1883. 150 p., illustr. 8°.

Jacques, V. Éléments d'embryologie, leçons recueillies à l'Université de Bruxelles. Bruxelles, *H. Manceaux*, 1883. 108 p., illustr. 12°.

Kengla, Louis A. Contributions to the archeology of the district of Columbia; an essay to accompany a collection of aboriginal relics, presented for the Toner medal, 1882. Washington, *Waters, pr.*, 1883. 4+42 p., 5 pl., map. 8°.

Lorentz, B., et **Parade**, A. Cours élémentaire de culture des bois créé à l'école forestière de Nancy. Paris, *Poitiers*, 1883. 28+721 p. 8°.

Malley, A. C. Micro-photography; including a description of the wet collodion and gelatino-bromide processes; together with the best methods of mounting and preparing microscopic objects for micro-photography. London, *Lewis*, 1883. 142 p. 8°.

Morelle, E. Recherches chimiques sur la bergenite. Lille, *imp. Danel*, 1883. 30 p. 8°.

North Carolina — Agricultural experiment station. Second biennial report of the director, Charles W. Dabney. 1881–82. Raleigh, *State*, 1883. 24 p., pl. 8°.

—— *The same.* [Bulletins.] i.–iv. 3 nos. [Raleigh], 1883. 20, 32, 16 p. 8°.

Page, D. Advanced text-book of physical geography. 3d ed., revised and enlarged by Charles Lapworth. London, *Blackwoods*, 1883. 350 p. 8°.

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